Chapter 4

Facility Requirements

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4. Facility Requirements

The relationship between demand and capacity with regard to the many functional elements of an airport are complex. There are numerous issues that affect how efficiently a certain level of activity (demand) can be processed within a specific system or facility (capacity). Furthermore, the level of service or convenience that is acceptable varies by user, facility, and stakeholder.

The purpose of this section is to explore the relationship between demand and capacity in the context of the Airport's functional areas and to provide a general assessment of the ability of these areas to meet future demand levels. The initial step of developing facility requirements uses current traffic activity levels to analyze and establish base case requirements for the Airport upon which future demand requirements are derived through the forecast horizon. The current traffic activity levels (the base) uses a typical busy 2015 weekday in the airport's peak month to establish what is referred to as the Peak Month Average Day (PMAD). Three planning horizon years were analyzed in detail looking out 5, 10, and 20 years from the base, namely 2020, 2025, and 2035.

Subsequent sections will present and explain in detail the demand/capacity analysis undertaken for each of the following:

- Airfield
- Terminal
- On-Airport Curbsides, Roadways & Parking
- Air Cargo
- General aviation
- Support facilities

This introduction provides an overview of the upcoming sections of this chapter. Each section describes the key findings from the analysis, any potential limitations in the system based on today's facilities, and areas that may require improvements/expansion to accommodate anticipated passenger and aircraft traffic levels through the forecast horizon.

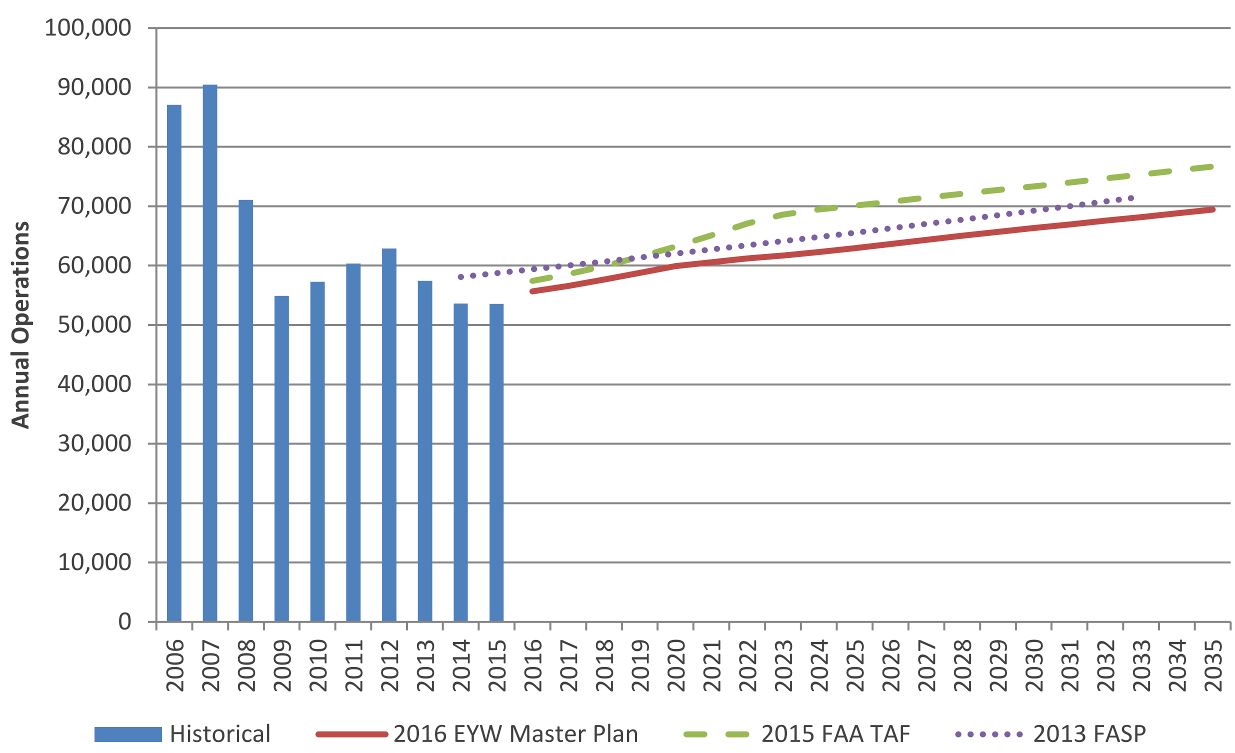
4.1 Airfield Facilities

This section serves to determine if any of the airside facilities will become inadequate to meet the various demand levels projected through 2035. This information will provide the basis of the next step in the planning process: the definition and evaluation of airside development alternatives, which is presented in Section 5.

4.1.1 AIRFIELD DEMAND/CAPACITY ANALYSIS

An airfield demand/capacity analysis was conducted to assess the capability of EYW's airfield facilities to accommodate existing and forecast aircraft operations through the planning horizon (2035), as depicted on **Exhibit 4.1-1**. Hourly runway capacity estimates were identified and compared to the peak hour design day flight schedule (DDFS) to determine if any airfield capacity enhancement measures may be required during the planning period (2015–2035). Details pertaining to the methodology and results of this analysis are documented in the following subsections.

Exhibit 4.1-1: Historical and Forecast Aircraft Operations



SOURCES: U.S. Department of Transportation, T-100, March 2016; Federal Aviation Administration, *2015 Terminal Area Forecast*, March 2016; Ricondo & Associates, Inc., March 2016 (Forecast).
PREPARED BY: Ricondo & Associates, Inc., September 2015.

Airfield capacity, also referred to as "throughput," is defined as the maximum number of aircraft operations that can be accommodated on an airfield during a specific period of time without incurring an unacceptable level of delay. Airfield capacity varies according to weather conditions, types of aircraft operating on the airfield, airfield configuration, and ATCT procedures. The number and location of runway exits and the share of touch-and-go operations also influence airfield capacity. Aircraft delay increases exponentially as the number of aircraft operations (i.e., demand) nears or exceeds the airfield capacity under a specific operating condition.

The following terms, as defined by the FAA, are used to describe the analysis:

- **Annual service volume (ASV).** As defined in Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay* (Change 2), ASV "is a reasonable estimate of an airport's annual capacity." In estimating ASV, the hourly, daily, and seasonal variations in aircraft demand associated with the airfield are considered, as well as the occurrence of low visibility and/or cloud ceiling heights, in which ATCT procedures are modified to maintain aircraft operational safety.
- **Average annual delay per operation.** This is an estimate of the average delay that each aircraft operation is expected to experience in a given year. Some aircraft operations, such as those occurring during peak operating hours, would likely experience higher delays, while other operations, such as nighttime operations, would likely experience little or no delay.

4.1.1.1 Factors Affecting Airfield Capacity

The capacity of an airfield, including the runways and associated exit taxiways, is not constant over time. A variety of factors can affect airfield capacity at an airport. These include:

- Airfield layout
- Percentage of time the airport experiences poor weather conditions (i.e., low cloud ceilings and/or low visibility)
- Aircraft fleet mix (types of aircraft operating at the airport)
- Frequency of touch-and-go operations
- Airfield operating configuration (runway use restrictions)
- Existing airfield demand/capacity and delay relationships
- Hourly airfield capacity

Airfield Layout

The number of runways, their orientation, the locations of runway intersections, and the lateral separation between parallel runways are primary factors affecting airfield capacity. The number of runway exits, their locations, and their type (high speed [oblique angle], 90 degree, etc.) also affect the capacity of the airfield.

Another factor affecting airfield capacity is the amount of time an aircraft occupies a runway. Runway occupancy time (ROT) for arriving aircraft is a function of the number, type, and location of runway exits, as well as aircraft performance. Typically, lighter aircraft require shorter runway distances for landing and, therefore, occupy the runway for a shorter time. However, if a runway exit is not available once the aircraft has decelerated to a speed that allows for safe maneuvering off the runway, then airfield capacity is reduced.

Obliquely angled exit taxiways, when properly located along a runway, can more effectively reduce ROTs than 90-degree exit taxiways. Angled exit taxiways are aligned at an oblique angle relative to the runway centerline, typically between 30 and 45 degrees relative to the runway orientation. This angle allows arriving aircraft to exit more expeditiously than standard exit taxiways that are perpendicular to the runway, which results in lower ROT and increased airfield capacity.

Weather Conditions

Airfield capacity can vary significantly based on the weather conditions at an airport. Prevailing winds (direction and speed) dictate which runways can be used for aircraft arrivals and departures. Aircraft typically land and take off into the wind and can accommodate a limited amount of crosswind and tailwind. If the maximum crosswind or tailwind is exceeded, then the aircraft may not operate safely on that particular runway. Therefore, wind conditions may prevent the use of a higher-capacity runway operating configuration, thereby increasing aircraft delay.

Other meteorological conditions affecting airfield capacity include cloud ceiling height and visibility. Low cloud ceilings and poor visibility result in increased spacing between aircraft in the airspace surrounding the airport. These conditions may also restrict which runways can be used, as arrivals in these conditions require the use of instrument landing systems. Visual flight rules govern the procedures used to conduct aircraft operations in VMC. Similarly, instrument flight rules govern the procedures used to conduct aircraft operations in IMC. The criteria defining the two operating conditions are summarized in **Table 4.1-1**.

Aircraft operate in a similar manner at EYW during VMC and IMC.

Table 4.1-1: Operating Conditions for Airfield Capacity and Aircraft Delay Analysis

	WEATHER CONDITIONS		
CLASSIFICATION	VISIBILITY		CLOUD CEILING
VMC	Greater than or equal to 3 statute miles	and	Greater than or equal to 1,000 feet above ground level
IMC	Less than 3 statute miles	and/or	Less than 1,000 feet above ground level

NOTES:

VMC – Visual Meteorological Conditions

IMC – Instrument Meteorological Conditions

SOURCE: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995.
PREPARED BY: Ricondo & Associates, Inc., October 2015.

Aircraft Fleet Mix

The aircraft fleet mix operating at an airport is an important factor in determining airfield capacity. As the range of approach speeds and aircraft weights increases, airfield capacity decreases because of the increased in-trail separation required to avoid wake vortices or wake turbulence. Turbulence is created behind an aircraft as a result of its movement through the air. Heavier aircraft produce more severe wake vortices than lighter aircraft. Although more prevalent during departures than arrivals, wake vortices are considered a significant safety hazard during any airborne operation.

To reduce the hazards associated with wake vortices, aircraft are spaced according to the differences in their airspeed and weight. Light aircraft are more susceptible to the effects of wake vortices than heavy aircraft. Therefore, light aircraft are typically required to wait up to 2 minutes before operating on a runway after a heavy aircraft. This delay results in a loss in airfield capacity. The greater the size and weight differential of the aircraft fleet using a specific runway, the greater the increased separation required between successive aircraft operations on that runway.

AC 150/5060-5, *Airport Capacity and Delay* (Change 2), refers to the "mix index" that accounts for aircraft fleet composition. The mix index is represented as a percentage to quantify the share of large aircraft in the fleet mix. To establish the mix index, aircraft are assigned to one of five categories based on the maximum certificated takeoff weight of the aircraft. Based on the number of operations in each classification, a percentage is established to quantify the share of total aircraft operations at an airport by aircraft type that result in wake turbulence hazards. **Table 4.1-2** summarizes the five aircraft classifications in accordance with the maximum certificated takeoff weight of the aircraft in the fleet mix.

Table 4.1-2: Aircraft Classifications for Establishing Aircraft Mix Index

WAKE TURBULENCE CLASSIFICATION	AIRCRAFT CLASS	MAXIMUM CERTIFICATED TAKEOFF WEIGHT (POUNDS)	REPRESENTATIVE AIRCRAFT
Small	A (single engine) B (multi engine)	12,500 or less	Piper P23, Cessna C-180, Cessna C-207, King Air
Small +	C	12,501 to 41,000	Lear 25, Cessna Citation, Grumman G-1
Large	C	41,001 to 225,000	Gulfstream IV, F-28, Dash 8, Boeing 737, Boeing 727
B757	C	225,001 to 300,000	Boeing 757-200/300
Heavy	D	300,001 or more	Boeing 767, DC-10, A380, Boeing 747-8

SOURCE: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

Touch-and-Go Operations

Touch-and-go operations are defined as operations by a single aircraft that lands and departs without stopping or exiting the runway. Pilots conducting touch-and-go operations are usually conducting training exercises and, therefore, stay in the airport traffic pattern. Airfield capacity, in terms of the number of aircraft operations possible, increases as the number of touch-and-go operations increases, since aircraft continually land and depart without incurring significant ROT. A touch-and-go operation is counted as two operations: one arrival and one departure. However, continuous touch-and-go operations reduce the availability of the runway for other non-training operations or may impede aircraft operations on nearby or intersecting runways. Although touch-and-go operations occur at EYW, it was assumed that there would be no touch-and-go operations during the peak hour.

Airfield Operating Configuration

As previously discussed, the layout of the airfield can result in a variety of operating configurations. Weather is a primary factor in dictating which operating configuration is used. However, other factors may influence operating configuration, including available runway departure and arrival lengths, the proximity of obstructions (structures and terrain), the proximity of other airports, and airspace constraints and interactions.

Aircraft performance characteristics may restrict aircraft operations on a runway. For departures, the available runway length must equal or exceed the runway length requirements specified for the departing aircraft. These requirements include the runway length needed for the takeoff ground roll, the runway length needed to clear an obstruction of a specified height (typically 35 feet above ground level), and the aircraft accelerate-stop distance. If the available runway length is not adequate to accommodate an aircraft, then that aircraft is required to depart from a runway that provides adequate departure length, or the aircraft payload must be reduced. Similarly, the landing distance available on the runway must exceed the landing distance requirements prescribed for the aircraft. Otherwise, the aircraft would be required to land on a longer runway.

Aircraft departures may also be restricted by the presence of obstacles. These restrictions are based on the climb performance of the aircraft and the location of the obstacle(s) relative to the departure route of the aircraft. Potential obstructions to aircraft takeoff and initial departure climb are of particular importance. Aircraft operations conducted under 14 CFR Part 121, *Operating Requirements: Domestic, Flag, and Supplemental Operations,* or 14 CFR Part 135, *Operating Requirements: Commuter and On-Demand Operations and Rules Governing Persons on Board Such Aircraft*, must adhere to an airport obstacle analysis prior to departure. If an obstacle prohibits the departing aircraft from meeting the minimum obstacle clearance requirements prescribed by the FAA, then the departure would not be permitted. The presence of this obstacle would restrict the use of the runway, thus affecting the airfield's operating configurations.

Runway use may also be predicated on regional ATCT procedures associated with nearby airports. The presence of neighboring airports often requires the shared use of navigational facilities or approach/departure fixes. In such cases, strict coordination between ATCT facilities is required, and the capacity of the overall regional airspace system could be restricted. In some instances, specific operating configurations at one airport may take precedence over operations at the other airport, which could restrict the use of certain operating configurations at the airport that has lower priority.

Existing Airfield Demand/Capacity and Delay Relationships

The estimated capacity of the existing airfield is presented in this section in terms of hourly capacity and ASV for each one of these planning horizons: 2015, 2020, 2025, and 2035 for the baseline scenario forecast.

For each runway use configuration, hourly capacities were established for operations during VMC and IMC. Historical weather and runway use data obtained from the FAA were used to determine how often each configuration is used. A weighted hourly capacity was then established based on the occurrence rate of each runway use configuration/weather condition and their respective hourly capacities. The weighted hourly capacity forms the basis for determining the airfield's ASV. ASV represents the estimated annual number of aircraft operations an airport can efficiently accommodate, with consideration of hourly, daily, and monthly operational patterns.[1]

AC 150/5060-5 presents the methodology for calculating hourly delay under a number of conditions that are representative of the seasonal and daily variations in demand, weather, runway use, and capacity. It is assumed that the variations in demand over the year can be characterized by a number of representative daily demands. The occurrences of different weather conditions and runway uses, and hourly runway capacity parameters corresponding to these occurrences, are provided as variables in the calculation. Hourly delays are established for each hour of the year using delay curves. The average delay per aircraft operation for the year is computed by aggregating the estimated hourly delays.

Hourly Airfield Capacity

When hourly demand begins to reach hourly capacity, aircraft delays grow at an increasing rate. These delays consist of extended arrival traffic patterns and departure queue delays in VMC, or they consist of holding patterns and flow control delays in IMC. As aircraft delays are most prevalent during peak demand periods, the hourly throughput of the airfield is compared with peak hour demand in the demand/capacity analysis. Peak hour demand that meets or exceeds hourly capacity is likely to result in delays during the peak demand period. The rate at which an airfield can "recover" from peak period delays is dependent on the operational demand profile throughout the day.

4.1.1.2 Methodology

Hourly runway capacity estimates were identified with the use of *runway*Simulator, which recently replaced the FAA's Airfield Capacity Model. Outputs of *runway*Simulator represent the most efficient airfield possible and, as such, the highest hourly capacities a specific airfield layout could yield; they are not necessarily representative of current airfield operations.

*runway*Simulator is a Monte Carlo simulation designed to estimate an hourly throughput capacity, not aircraft delay, of a runway system given a set of inputs that includes the following components:

- **Airfield Layout**: Runway geometry data (e.g., locations, dimensions, exits, fixes, etc.) imported from the FAA's AVNIS database or created manually.
- **Arrival and Departure Procedures**: Dependent upon the airfield layout but establishes a template for flight movements based on arrival and departure procedure assignments.

1 The formula for calculating ASV consists of three variables: CW (weighted hourly capacity), D (the ratio of annual demand to average daily demand in the peak month), and H (the ratio of average daily demand to average peak hour demand during the peak month). These variables are multiplied together (CW*D*H) to obtain the ASV for the Airport

- **Aircraft Fleet Mix**: Fleet mix is the makeup of aircraft demand (derived from the forecast) to be generated for the capacity mode scenarios.
- **Procedure Eligibility**: Assigns specific aircraft types to individual runways via the defined arrival and departure procedures.
- **Separation Rules**: Dictates the timing of flights in the simulation, which is constrained by a variety of separation rules and regulations as defined by the FAA.[2]

To calculate the hourly throughput capacity, *runway*Simulator assumes a saturated-conditions schedule, represented by a continuous arrival and departure stream in proportion to the input aircraft fleet mix. The arrival and departure stream is characterized by there always being an aircraft waiting to land and takeoff (i.e., a continuous demand for service). These hourly estimates only account for the airspace constraints that impact the final approach spacing to the runways, dependent runway operations, and taxiways that serve as runway exits. The estimates do not account for any other airspace or ground constraints. *runway*Simulator does not provide any estimate of delay.

The resulting hourly capacity estimates were compared to the peak hour forecast to determine if the forecast demand exceeded the existing airfield capacity, which would then prompt a consideration of measures to increase the airfield capacity.

Airfield Operating Configurations and Procedures

In estimating the hourly capacity for the existing EYW airfield, two airfield operating configurations were considered—East Flow and West Flow—both in VMC and IMC, as presented in **Table 4.1-3**, along with corresponding occurrence percentages. Each of these configurations was simulated to determine the most efficient operating configuration.

Aircraft Fleet Mix Assumptions

The VMC and IMC aircraft fleet mixes were derived from the DDFS forecast. *runway*Simulator provides a finite number of aircraft types that generally align with the mix-index aircraft classifications contained within AC 150/5060-5, *Aircraft Capacity and Delay* (Change 2). To establish a fleet mix useable in the simulation, the DDFS aircraft types were mapped to the *runway*Simulator aircraft classifications, where applicable. **Table 4.1-4** presents the *runway*Simulator DDFS aircraft fleet mix mapping for the baseline forecast scenario.

2 Federal Aviation Administration, JO 7110.65V, *Air Traffic Control*, February 2014.

Table 4.1-3: Airfield Operating Configurations

VISUAL METEOROLOGICAL CONDITIONS		INSTRUMENT METEOROLOGICAL CONDITIONS	
FLOW	**OCCURRENCE**	**FLOW**	**OCCURRENCE**
East: A 9, D 9	85.4%	East: A 9, D 9	0.9%
West: A 27, D 27	13.5%	West: A 27, D 27	0.2%%
	98.9%		1.1%

NOTES:

A – Arrival

D – Departure

SOURCES: National Centers for Environmental Information (NCEI), EYW Airport 3505 Surface Hourly Weather Observations (January 1, 2006 – December 31, 2015; 87,463 total observations), retrieved June 2016; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Table 4.1-4: *runway*Simulator Aircraft Fleet Mix Mapping

RUNWAY SIMULATOR AIRCRAFT CLASSIFICATION	DDFS AIRCRAFT TYPES
Airbus 380 (A388)	N/A
Boeing 777 (B772)	Boeing 777, Airbus A350, Boeing 787
Boeing 767 (B763)	Boeing 767, MD-11, DC-10
Boeing 757 (B752)	Boeing 757
Boeing 737 (B737)	MD 80, Airbus 319, Airbus A321, Airbus A320, Boeing 73, Boeing 717
Dash 8-400 (DH8D)	N/A
CRJ-200 (CRJ2)	CRJ-700, CRJ-900, ERJ 140, ERJ 145, ERJ 175, ERJ-190
Dash 8-100 (DH8A)	Bombardier Q400
Embraer 120 (E120)	N/A
Cessna Citation V (C560)	Lear Jet 60, Hawker 800, Gulfstream IV, Gulfstream V, Global Express
Cessna Citation (C510)	N/A
Piper Navajo PA-31 (PA31)	Cessna 310
King Air C90 (BE9L)	Socata TBM-850
Piper Cherokee PA-28 (P28A)	Piper Cherokee, Beach Bonanza, Beech Baron
Cessna 208 (C208)	Cessna 172, Cessna 208, Diamond DV-20, Diamond DV-40, Cirrus SR20

NOTE:

N/A – Not Applicable

SOURCES: MITRE, *runway*Simulator, v0.0.1, November 2015; Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedule*, July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Utilizing the mappings presented in Table 4.1-4, VMC and IMC peak hour fleet mixes were developed for the following operational configurations for the baseline forecast scenarios, as shown in **Table 4.1-5**.

Table 4.1-5: Peak Hour by Type of Operation (Baseline Forecast)

OPERATION TYPE	2015 PEAK HOUR	2035 PEAK HOUR
ALL	11:50 a.m. to 12:50 p.m.	10:00 a.m. to 11:00 a.m.
ARRIVAL	7:30 a.m. to 8:30 a.m.	8:30 a.m. to 9:30 a.m.
DEPARTURE	12:10 p.m. to 1:10 p.m.	10:00 a.m. to 11:00 a.m.

SOURCE: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedule*, July 2016.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

Hourly Capacity Estimates

The peak hour total operations, arrivals, and departures fleet mixes were modeled for the 2015, 2020, 2025, and 2035 fleet mixes in *runway*Simulator, based on the airfield operating configurations previously identified in Table 4.1-3. The results of that analysis are presented in **Table 4.1-6**.

It should be noted that, for purposes of evaluating airfield capacity, the demand/capacity assessment focused on the hourly capacity estimates for the condition representative of 50 percent arrivals and 50 percent departures.

Table 4.1-6: Estimated Hourly Capacities of the Existing Airfield Configuration (Baseline Scenario)

	VISUAL METEOROLOGICAL CONDITIONS		INSTRUMENT METEOROLOGICAL CONDITIONS	
EXISTING AIRFIELD LAYOUT	MIX INDEX	HOURLY CAPACITY (50% ARRIVALS)	MIX INDEX [1/]	HOURLY CAPACITY (50% ARRIVALS)
EXISTING (2015)				
East Flow	43.0%	63	43.0%	46
West Flow	43.0%	62	43.0%	46
2020				
East Flow	45.0%	66	45.0%	46
West Flow	45.0%	66	45.0%	46
2025				
East Flow	46.0%	65	46.0%	46
West Flow	46.0%	65	46.0%	46
2035				
East Flow	46.0%	66	46.0%	46
West Flow	46.0%	67	46.0%	47

NOTE:
Mix Index – (Percent of Large Aircraft) + (3 * Percent of Heavy Aircraft)

SOURCES: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

As shown in Table 4.1-6, the 2035 forecast hourly capacity is slightly higher than that for the 2015 existing airfield in VMC, with a high of 67 operations in west flow (baseline scenario). The difference in hourly capacity is generally related to a higher number of large aircraft in 2035, resulting from an increase in passenger service by regional jets and medium narrowbody aircraft. As expected, the hourly capacity estimates under IMC are lower than the estimates under VMC as a result of increased separation requirements between successive aircraft operations.

The slight increase in the VMC and IMC mix index from 43.0 percent in 2015 to 46.0 percent in 2035 is considered negligible, and it would have a minimal impact on the airfield's hourly capacity. This increase is attributed to a small increase in the share of regional jet aircraft and medium narrowbody aircraft.

4.1.1.3 Hourly Demand/Capacity Comparisons

Exhibit 4.1-2 presents the hourly capacity estimates associated with each airfield operating configuration and peak hour demand at the Airport in 2015 (existing) for the baseline forecast. **Exhibit 4.1-3** through **Exhibit 4.1-5** present comparisons of the hourly capacity estimates associated with each airfield operating configuration and peak hour demand at the Airport forecast for 2020, 2025, and 2035 (for the baseline forecast).

Each exhibit presents a separate comparison for VMC and IMC weather conditions, assuming an arrivals mix of 50 percent.

As shown, the VMC and IMC peak hour aircraft operations are not anticipated to exceed the hourly airfield capacity under any of the runway operating configurations throughout the planning horizon.

Annual Service Volume

The peak hour airfield capacity estimates for the Airport serve as the basis for establishing the ASV of the existing airfield. The ASVs are then compared with the annual aircraft operational demand forecast for 2020, 2025, and 2035. As annual demand exceeds the ASV of the airfield, aircraft delay increases exponentially. To minimize aircraft delay, the FAA recommends that planning for additional airfield capacity begin when the airfield's annual demand reaches 60–75 percent of its ASV.[3] Identification of the demand level at which this would occur requires quantification of annual demand expressed as a share (percent) of the ASV. **Table 4.1-7** presents this comparison for the operational demand experienced during 2015 and what has been forecast for 2020, 2025, and 2035. The table also presents annual demand expressed as a percentage of the ASV, as well as the estimated peak hour demand.

As shown, the ASV at the Airport during 2015 (baseline forecast) was estimated at 173,000 operations, while actual annual demand numbered approximately 54,000 operations. As a result, the annual demand during 2015 represented approximately 31 percent of the ASV. Since this percentage does not exceed 60 percent, planning for additional airfield capacity at EYW is not yet necessary. Annual demand is not anticipated to exceed the ASV throughout the planning horizon under the baseline forecast. The relationship between annual service volume and annual demand is graphically depicted on **Exhibit 4.1-6** for the baseline forecast scenario.

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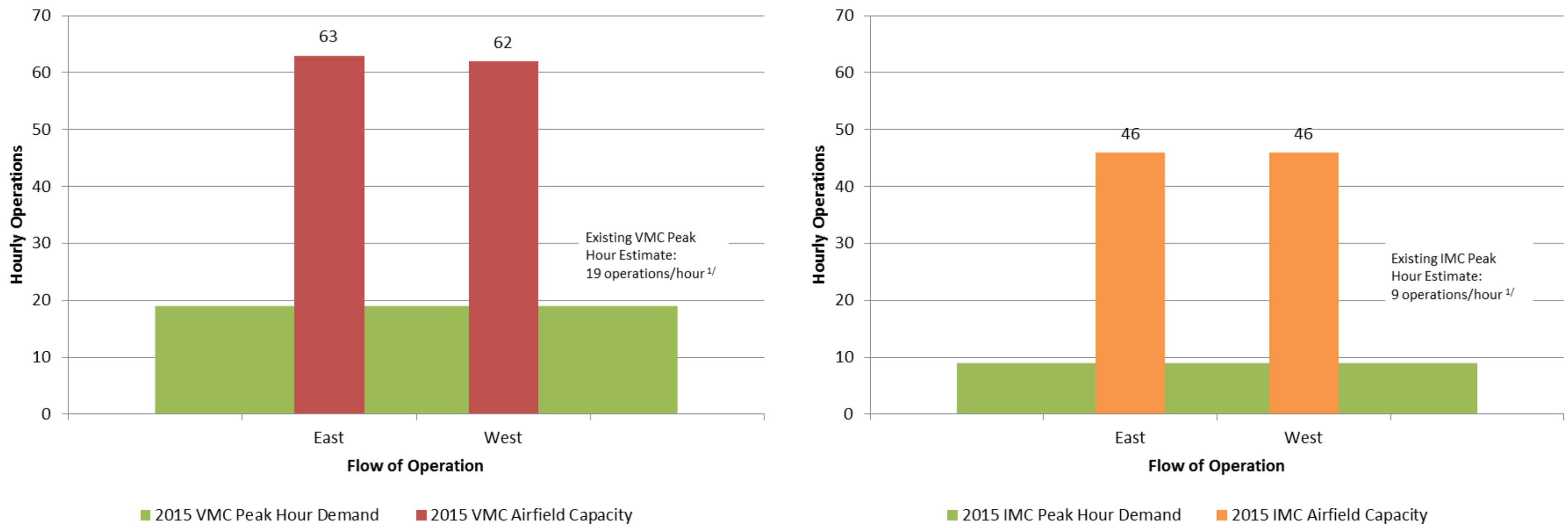
[3] Federal Aviation Administration, Order 5090.3C, *Field Formulation of the National Plan of Airport Integrated Systems (NPIAS)*, December 4, 2000.

Exhibit 4.1-2: 2015 Hourly Airfield Demand/Capacity Comparison—Existing Airfield (Baseline Forecast)



NOTES:

1/ Assumes 50 percent arrivals.

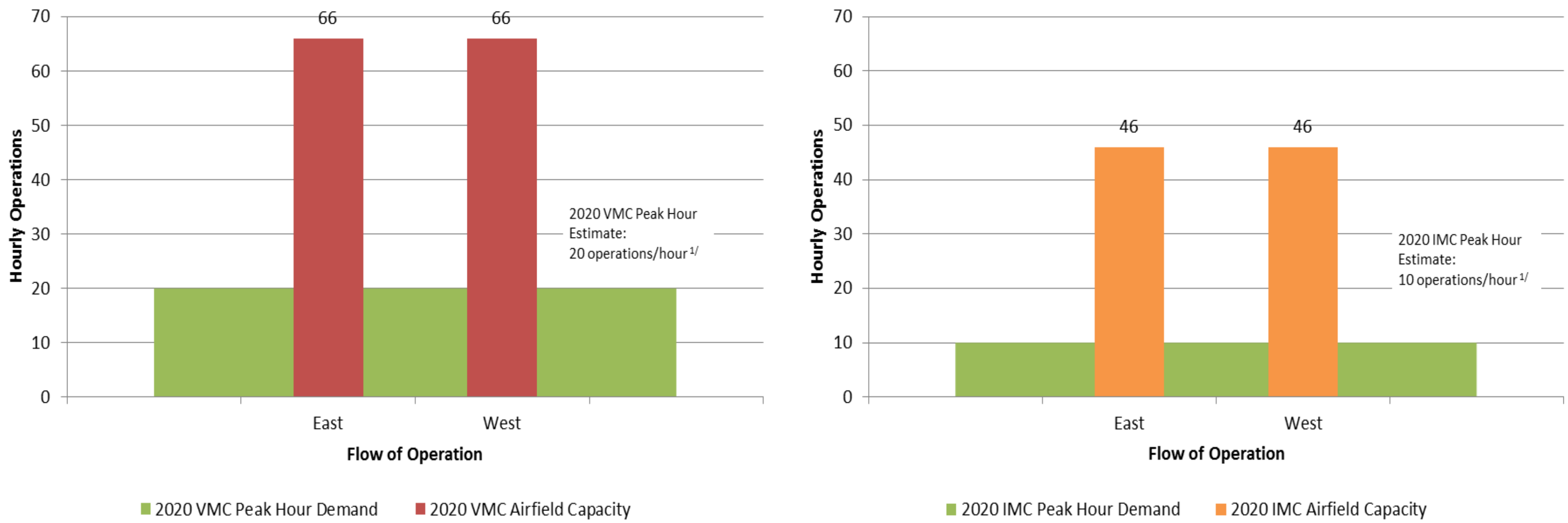
VMC – Visual Meteorological Conditions

IMC – Instrument Meteorological Conditions

SOURCES: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedules*, July 2016; Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Exhibit 4.1-3: 2020 Hourly Airfield Demand/Capacity Comparison—Existing Airfield (Baseline Forecast)



NOTES:

1/ Assumes 50 percent arrivals.

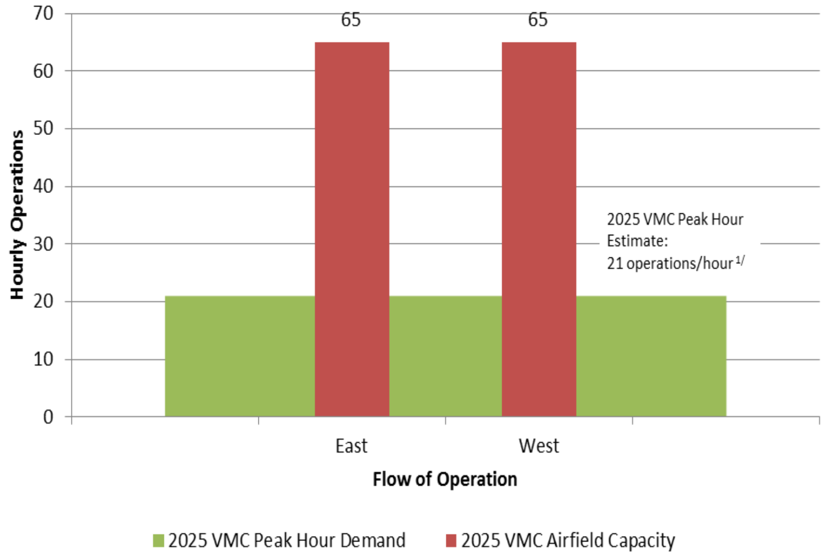
VMC – Visual Meteorological Conditions

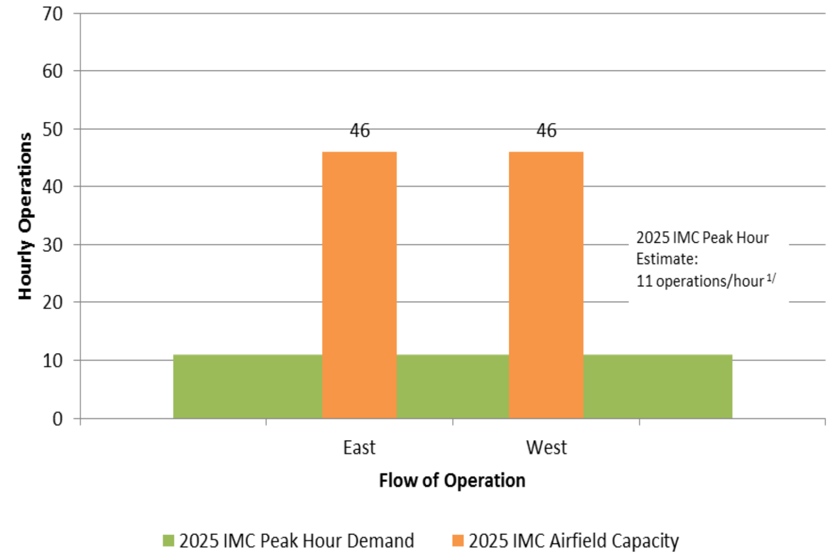
IMC – Instrument Meteorological Conditions

SOURCES: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedules*, July 2016; Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Exhibit 4.1-4: 2025 Hourly Airfield Demand/Capacity Comparison—Existing Airfield (Baseline Forecast)





NOTES:

1/ Assumes 50 percent arrivals.

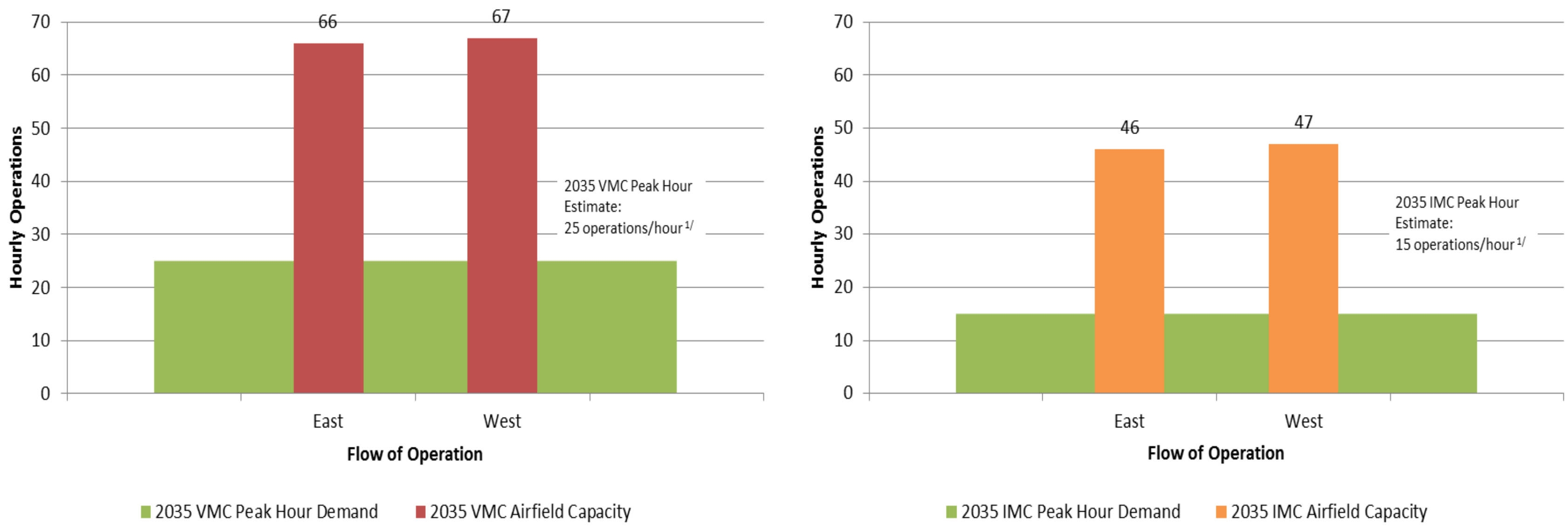
VMC – Visual Meteorological Conditions

IMC – Instrument Meteorological Conditions

SOURCES: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedules*, July 2016; Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Exhibit 4.1-5: 2035 Hourly Airfield Demand/Capacity Comparison—Existing Airfield (Baseline Forecast)



NOTES:

1/ Assumes 50 percent arrivals.

VMC – Visual Meteorological Conditions

IMC – Instrument Meteorological Conditions

SOURCES: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedules*, July 2016; Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Table 4.1-7: Comparison of Annual Demand and Annual Service Volume

CAPACITY/DEMAND METRIC	EXISTING 2015	2020	2025	2035
Estimated Peak Hour Demand:				
VMC	19	20	21	25
IMC	9	10	11	15
Annual Service Volume	173,000	193,000	190,000	179,000
Annual Demand:				
Aircraft Operations	54,000	60,000	63,000	69,000
Percent of Annual Service Volume	31%	31%	33%	39%

NOTES:

VMC – Visual Meteorological Conditions

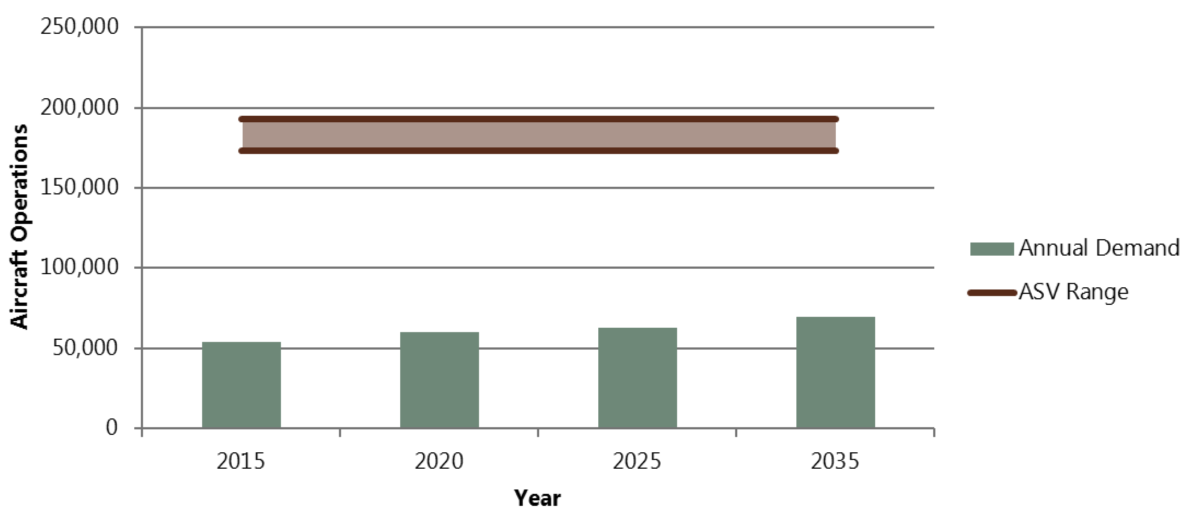
IMC – Instrument Meteorological Conditions

1/ Annual service volume and aircraft operations rounded to nearest thousand.

SOURCES: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., July 2016.

PREPARED BY: Ricondo & Associates, Inc., July 2016.

Exhibit 4.1-6: Annual Service Volume vs. Annual Demand Relationship (Baseline Forecast)



NOTE:

1/ ASV – Annual Service Volume

SOURCES: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., August 2016.

PREPARED BY: Ricondo & Associates, Inc., August 2016.

As depicted on Exhibit 4.1-6, the ASV remains higher than the annual demand throughout the planning horizon.

Airfield Delay

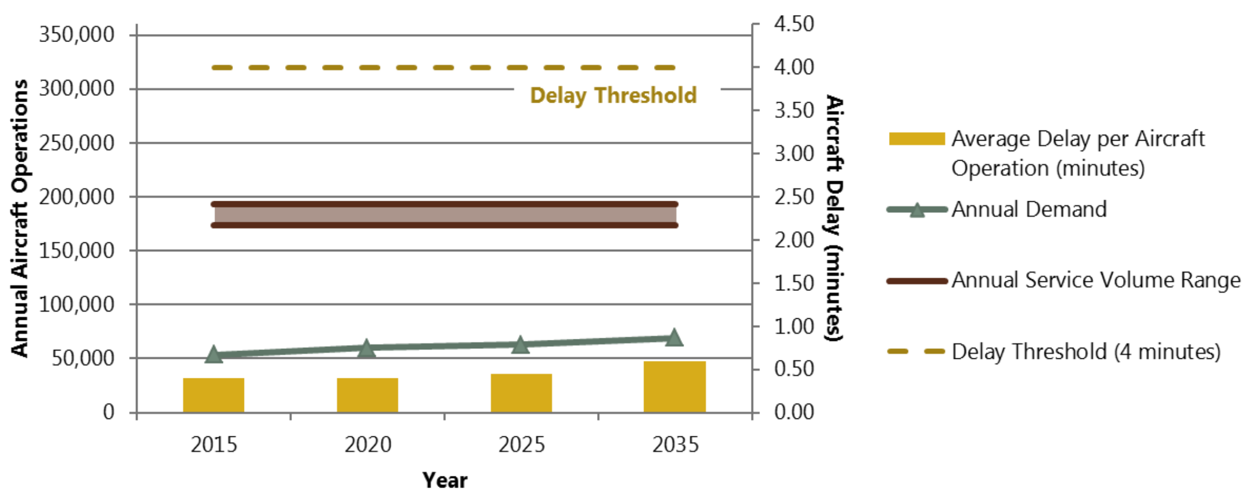
For long-term planning, AC 150/5060-5, *Airport Capacity and Delay* (Change 2), recommends using a general demand versus capacity comparison to estimate the average delay associated with the airfield. For purposes of this analysis, the ratio of annual demand to the airfield ASV serves as the basis for developing delay estimates.

The aircraft delay estimates provide the basis for justifying capacity improvements, as they demonstrate the true operational consequences associated with exceeding the airfield's ASV.

It should be noted that the delay estimates contained in AC 150/5060-5 reflect delays associated with runways only. Additional delays associated with local airspace constraints, aircraft taxiing operations, and gate occupancies are not included. These other components of delay cannot be reasonably quantified without the use of advanced airfield and airspace simulation tools. As the delay estimates presented herein reflect delay associated exclusively with the runway components, the recommended maximum allowable delay per operation is between 4.0 and 6.0 minutes.[4] On that basis, airfield capacity enhancements should be implemented prior to reaching or exceeding this delay threshold.

Exhibit 4.1-7 graphically presents the relationship among demand, capacity, and delay through 2035 under the baseline forecast. The exhibit presents a comparison of the forecast increase in annual demand with the ASV of the existing airfield through 2035, superimposed on the resulting average delay per aircraft operation. As shown, the average aircraft delay (runway component only) currently experienced at EYW is approximately 0.4 minutes, and it is anticipated to be 0.6 minutes in 2035; both delays are well below the typical threshold of unacceptable delay in the airline industry.

Exhibit 4.1-7: Relationship of Demand, Capacity, and Delay (Baseline Forecast)



NOTE:

1/ Minutes of delay reflects runway component only.

SOURCES: Federal Aviation Administration, Advisory Circular 150/5060-5, *Airport Capacity and Delay* (Change 2), December 1, 1995; Ricondo & Associates, Inc., August 2016.

PREPARED BY: Ricondo & Associates, Inc., August 2016.

4 Federal Aviation Administration, AC 150/5070-6B, *Airport Master Plans*, May 2007.

Existing Airfield Demand/Capacity Conclusions

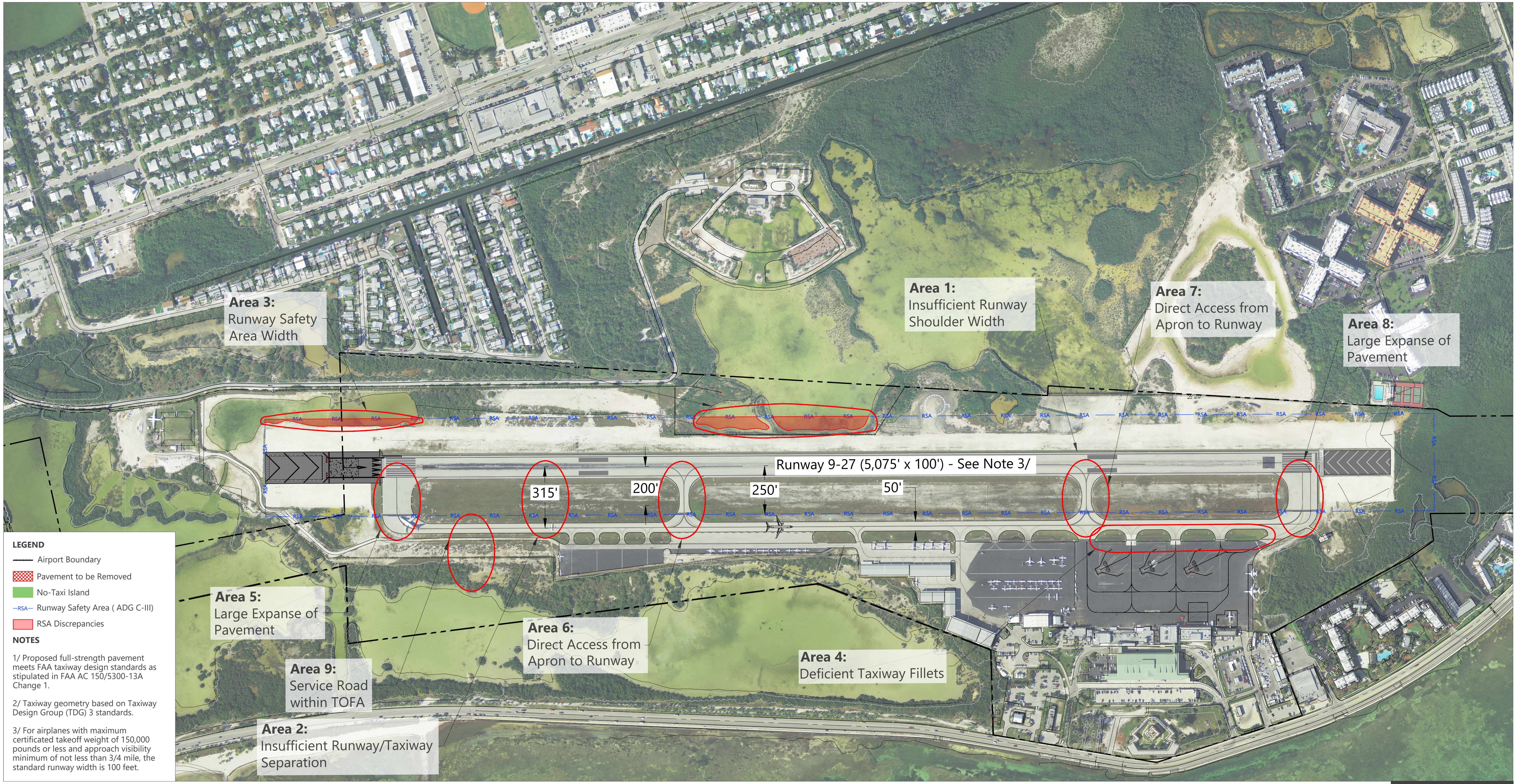
The airfield demand/capacity analysis determined that the existing runway layout is adequate to accommodate existing (2015) and future (2035) operational demand at the Airport under the baseline forecast scenario. Based on the average delay per aircraft operation, there is no need for additional airfield capacity throughout the planning horizon.

4.1.2 AIRFIELD GEOMETRY

The airfield consists of the runway, taxiways, taxilanes, and apron areas. These facilities support the maneuvering of aircraft at the Airport. This section provides an assessment of airfield improvements identified for EYW. Specifically, the following sections will discuss runway, taxiway, and other airfield facility requirements necessary to support the various types and level of aircraft operations expected over the course of the planning horizon. An assessment of airfield geometry principles and dimension standards was conducted, based on guidance set forth in FAA AC 150/5300-13A, *Airport Design*, for Airplane Design Group (ADG) III and Taxiway Design Group (TDG) 3 aircraft. A total of eight areas of noncompliance were identified and are highlighted on **Exhibit 4.1-8**. The following is a list of the eight areas of noncompliance:

- Area 1 - runway shoulders' width (increase from 10 feet to 20 feet)
- Area 2 - runway-to-taxiway separation (currently 315 feet instead of 400 feet)
- Area 3 - runway safety area width (less than 500 feet)
- Area 4 - Taxiway A: widen connectors into apron to allow cockpit over centerline taxiing
- Area 5 - Taxiway B: wide expanse of pavement
- Area 6 - Taxiway C: direct access from apron to runway
- Area 7 - Taxiway D: direct access from apron to runway
- Area 8 - Taxiway E: wide expanse of pavement

Resolution of these areas of noncompliance will be addressed in the Alternatives Development section.



SOURCE: Jacobs, September 2015 (Basemap and Aerial Photography).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 4.1-8

NORTH 0 500 ft

Airfield Geometry Areas of Noncompliance

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Airfield Geometry\CAD\Exhibit 4.1-8_Airfield Geometry Areas of Non-Compliance.dwgLayout: 11x17L Plotted: Jun 11, 2020, 04:33PM

4.1.2.1 Critical Aircraft and Airport Reference Code

The Airport Reference Code (ARC) is a coding system outlined in FAA AC 150/5300-13A, *Airport Design* (Change 1), as the basis for specifying applicable airport design standards. The intent of the ARC is to provide a simple method for compiling the numerous dimensional and performance specifications of the aircraft that operate at an airport into criteria that will define the dimensional and design standards of airport facilities. The ARC is based on an aircraft's wingspan or tail height and approach speed. It relates the operational and physical characteristics of the most demanding aircraft expected to operate at, or make substantial use of, the airport, to airport design criteria. The airport design criteria include the size of runway safety areas, runway and taxiway/taxilane length and width, and separation distances. The most demanding aircraft is often referred to as the critical aircraft. As stated in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, the critical design aircraft must have at least 500 or more annual itinerant (does not include local operations) or scheduled commercial service operations at the airport.

Once the critical aircraft characteristics have been identified, they are used to determine the ARC, which is identified using an alphanumeric designation, a letter designator followed by a roman numeral used to identify the two specific characteristics of an aircraft: approach speed and wingspan. The letter designator is used to identify the aircraft approach category based upon aircraft approach speeds, and the roman numeral designates the ADG in terms of wingspan. Generally, aircraft approach speed affects runway length and runway-related facilities, such as navigational aids, while aircraft wingspan primarily affects separation criteria involving taxiways and taxilanes. It is not unusual for the critical aircraft and ARC to be adjusted over time as the aircraft fleet evolves. **Table 4.1-8** summarizes the FAA aircraft classifications as presented in AC 150/5300-13A Change 1, and it also lists typical aircraft by aircraft approach category and ADG.

Aircraft approach categories A and B typically include small piston-engine and turboprop aircraft and a limited number of smaller business jets having approach speeds of less than 121 knots. Categories C, D, and E consist of the larger jet and turboprop aircraft generally associated with commercial and/or military use. ADG I and II primarily include small piston aircraft, very light, light, and midsize business jets, and a variety of single- and twin-engine turboprop aircraft. ADG III, IV, and V include a limited number of large business jet models that have entered the fleet over the last 5–7 years, including the Gulfstream G350, G450, and G550, as well as the majority of the commercial jet aircraft fleet. ADG VI includes very large jets such as the Airbus A380 and the Antonov 124 transport aircraft.

Table 4.1-8: Federal Aviation Administration Airport Reference Code

AIRCRAFT APPROACH CATEGORY		
CATEGORY	**APPROACH SPEED (KNOTS)**	**TYPICAL AIRCRAFT BY APPROACH CATEGORY**
A	< 91	Cessna 172, Beech Bonanza, Cirrus SR-22, Diamond DA-42
B	91 < 121	Cessna 441, Beech 1900C, King Air 200, Citations II/III/V, Falcon 2000
C	121 < 141	Astra Galaxy, Challenger 604, CRJ, Global Express, Citations VI/VII/X, Airbus A320, Boeing BBJ, Boeing-737-100/300/400/500/700, Boeing757, Boeing767
D	141 < 166	Gulfstream G400/G500/G550, Airbus A310-300, A330-300, A340, Boeing 737-800/900 w/winglets, Boeing747, Boeing777-300, DC-10, MD-11
AIRPLANE DESIGN GROUP (ADG)		
DESIGN GROUP	**WINGSPAN (FEET)**	**TYPICAL AIRCRAFT BY ADG**
I	< 49	Cessna 172, Cessna 402, Beech 400A, Cirrus SR-22, Diamond DA-42
II	49 < 79	Beech 1900C, King Air 200, CRJ-200, Citations V & X, Falcon 2000, Gulfstream G350/G450
III	79 < 118	Bombardier CRJ-700, Airbus A318/A319/A320/A321, Boeing 727, Boeing 737, MD-80, DC-9, Gulfstream G550, G650
IV	118 < 171	Airbus A300/A310, Boeing 757/767, DC-8, MD-11
V	171 < 214	Airbus A330/A340/A350, Boeing 747, Boeing 777, Boeing 787-8/-9
VI	214 < 262	Airbus A380, Antonov 124

SOURCE: Federal Aviation Administration, AC 150/5300-13A, *Airport Design* (Change 1), February 2014.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

To determine the facility requirements at EYW, a critical aircraft was selected based upon the types of aircraft generally operating at the Airport—aircraft with more than 500 annual operations and that are anticipated in the future based upon the forecast fleet mix and operation types, as the aviation forecasts depicted in Section 3.

The Boeing 737-700 currently is the Airport's critical aircraft, based upon wingspan and approach speed, and it is anticipated to remain the critical aircraft through the planning horizon. This aircraft falls within approach category C and ADG III. Thus, the appropriate ARC for the Airport is C-III. Taxiway/taxilane width and fillet standards and, in some instances, runway-to-taxiway and taxiway/taxilane separation requirements are determined by the TDG. The TDG for the Boeing 737-700 is TDG 3.

4.1.2.2 FAA Design Standards

Table 4.1-9 presents the dimensional design standards for ARC C-III and TDG 3, as listed in FAA AC 150/5300-13A (Change 1), as well as the key dimensions for the existing airfield facilities. This table provides the foundation for assessing future facility needs.

Table 4.1-9: Federal Aviation Administration Design Standards for ARC C-III and TDG 3

	EXISTING RUNWAY			
	RWY 9	RWY 27	AIRPORT REFERENCE CODE C-III STANDARDS	TAXIWAY DESIGN GROUP 3 STANDARDS
Runway Centerline to Holdline	152 feet	152 feet	250 feet	N/A
Runway Centerline to Taxiway/Taxilane Centerline	315 feet		400 feet	N/A
Runway Centerline to Aircraft Parking Area	473 feet		500 feet	N/A
Taxiway and Taxilane Separation Standards	-	-	-	N/A
Taxiway Centerline to Parallel Taxiway/Taxilane Centerline	-		152 feet	N/A
Taxiway Centerline to Fixed or Movable Object	68 feet		93 feet	N/A
Taxilane Centerline to Parallel Taxilane Centerline	-		140 feet	N/A
Taxilane Centerline to Fixed or Movable Object	-		81 feet	N/A
RUNWAY PROTECTION ZONE DIMENSIONS				
Length	1,700 feet		1,700 feet	N/A
Inner Width	500 feet		500 feet	N/A
Outer Width	1,010 feet		1,010 feet	N/A
RPZ Acres	29.465		29.465	N/A
RUNWAY DESIGN STANDARDS				
Runway Width	100 feet		150 feet 1/	N/A
Runway Shoulder Width	10 feet		20 feet 1/	N/A
Runway Blast Pad Width	100 feet		200 feet	N/A
Runway Blast Pad Length	150 feet		200 feet	N/A
Runway Safety Area Width	350–400 feet		500 feet	N/A
Runway Safety Area Length Prior to Landing Threshold	240 feet	240 feet	600 feet	N/A
Runway Safety Area Length Beyond Runway End	240 feet	240 feet	1,000 feet	N/A
Runway Object Free Area Width	500 feet		800 feet	N/A
Runway Object Free Area Length Beyond Runway End	240 feet	240 feet	300 feet	N/A
TAXIWAY DIMENSIONAL STANDARDS				
Taxiway Width	-		-	50 feet
Taxiway Edge Safety Margin	-		-	10 feet
Taxiway Shoulder	N/A		-	20 feet
Taxiway Safety Area Width	79 feet		118 feet	-
Taxiway Object Free Area Width	131 feet		186 feet	-
Taxilane Object Free Area Width	Varies		162 feet	-

NOTES:

1/ For airplanes with maximum certificated takeoff weight of 150,000 pounds or less and approach visibility minimums of not less than three-quarter miles, the standard runway width is 100 feet, the shoulder width is 20 feet, and the runway blast pad width is 140 feet.

SOURCE: Federal Aviation Administration, AC 150/5300-13A, *Airport Design* (Change 1), February 2014.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

4.1.2.3 Runway Geometry

As indicated in Section 4, the Airport is not anticipated to experience significant runway capacity constraints during the planning period. Nonetheless, runways should be designed with adequate length, width, and pavement strength to accommodate the most demanding or critical aircraft. The runways should be designed in accordance with the standards developed by the FAA, using the ARC and Runway Design Code systems.

The existing runway geometry deficiencies are illustrated on Exhibit 4.1-8 and are described in more detail in this subsection.

Runway Length

This subsection discusses the runway length that would allow the Airport to meet the operational requirements of current and forecast users. Runway length is a critical component at each airport. While insufficient runway length may restrict operations by some aircraft, too long of a runway may result in unnecessary maintenance costs. As reflected in Section 2, Runway 9-27 has an overall length of 5,075 feet and a width of 100 feet.

The runway length analysis determines the maximum runway length required to accommodate various aircraft at expected ranges (longest nonstop distances to be flown from EYW). According to FAA planning guidance, the recommended length of a primary runway is determined by considering either the family of aircraft with similar performance characteristics or a specific aircraft type needing the longest runway. In either case, the choice should be based on aircraft that are reasonably expected to use the runway on a regular basis, which is at least 500 operations a year (landings and takeoffs combined), as defined in AC 150/5325-4B, *Runway Length Requirements for Airport Design*.[5]

AC 150/5325-4B states: "For federally funded projects, the airport designer must take into account the length of haul (range) that is flown by airplanes on a substantial use basis." This requirement is predicated on the fact that aircraft takeoff weights are influenced by the amount of fuel payload required to travel to the destination, including minimum fuel reserves prescribed by the FAA. Therefore, in determining runway length requirements to serve aircraft departures, the nonstop markets that are forecast to be served from the Airport through 2035 were considered; these markets are summarized in **Table 4.1-10**, along with the distance from EYW and anticipated aircraft type for each route.

[5] Federal Aviation Administration, Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, July 2005.

Table 4.1-10: Nonstop Markets Served from EYW (through 2035)

NONSTOP MARKET	DISTANCE FROM EYW (NAUTICAL MILES)	AIRCRAFT TYPE
Atlanta, GA (ATL)	561	B737-700, CRJ-700, CRJ 900, A319, B717-200
Charlotte, NC (CLT)	639	Embraer 170, Embraer 175, Embraer 190, CRJ 700
Washington, D.C. (DCA)	889	Embraer 170, CRJ 700
Newark, NJ (EWR)	1,039	Embraer 170
New York (Jamaica), NY (JFK)	1,052	Embraer 190
Chicago, IL (ORD)	1,087	Embraer 170
Toronto, Canada (YYZ)	1,171	B737-700, Embraer 175
Boston, MA (BOS)	1,206	Embraer 190

SOURCE: Ricondo & Associates, Inc., *EYW Master Plan Design Day Flight Schedules*, November 2016; Monroe County Department of Airports, January 2019.
PREPARED BY: Ricondo & Associates, Inc., November 2016.

The runway length requirements presented herein were also defined in accordance with the various aircraft manufacturers' manuals on aircraft characteristics for airport planning. These manuals provide information on most of the factors that influence the runway length required for aircraft operations. Other sources, such as FAA advisory circulars, were also used for those factors not covered in the manuals.

Planning Factors

The planning factors that were used in the runway length determination included the following:

- **Aircraft Type:** The runway length analysis is based on the aircraft fleet mix identified in the DDFS for the forecast scenarios. Runway length requirements were considered for aircraft operating long-haul international flights.
- **Aircraft Weight:** Aircraft weight is the single most important factor when conducting a runway length analysis. As the weight of a particular model of aircraft increases, the runway length requirement increases for a given condition. The weight of each aircraft type can vary considerably depending on payload (passengers, baggage, and cargo) and the amount of fuel on board to fly a defined stage length.
- **Engine Model:** Since engine models for aircraft operating long-haul international routes cannot be identified at this point, all engine model variations were considered in this evaluation.
- **Weather (temperature, prevailing winds, etc.):** Performance characteristics of the most demanding weather conditions that typically occur at the Airport were considered. The runway length requirements provided herein reflect the aircraft performance characteristics during the manufacturer-defined "hot

day" (84°F to 92°F) and zero-wind conditions. The maximum daily temperature at EYW is 89.4°F, and occurs during the month of August.[6]

- **Flap Settings:** Most aircraft have a variety of flap settings that affect runway length requirements. The optimal aircraft flap settings for takeoff performance were used in the analyses.
- **Airport Elevation:** Aircraft performance is also affected by the elevation of the airfield. The runway length requirements were adjusted to consider the published Airport airfield elevation of 435 feet above mean sea level.
- **Runway Surface Conditions:** AC 150/5325-4B addresses the implications of wet, slippery pavement conditions. In accordance with this document, landing runway length requirements should be increased to accommodate wet pavement conditions when assessing the needs of turbojet-powered aircraft. When data pertaining to landing distances on wet runways are unavailable, a net increase of 15 percent is recommended. Takeoff runway length requirements prescribed by the aircraft manufacturers do not require adjustments to account for wet pavement conditions.
- **Runway Gradient:** The runway lengths obtained from the Aircraft Characteristics for Airport Planning manuals were increased by 370.0 feet, in order to account for 37.6 feet of elevation difference between the highest and lowest points along the Runway 5R-23L centerline, as prescribed in AC 150/5325-4B, §509.
- **Aircraft Fleet Mix:** As aircraft performance characteristics vary, the establishment of a preferred runway length does not require evaluation of every aircraft type. Only the most demanding aircraft types, in terms of runway length and width, need to be evaluated. For the purposes of this analysis, the aircraft fleet mixes contained in the 2035 DDFS were sorted to identify aircraft anticipated to operate long-haul international flights from EYW.

Takeoff Runway Length Requirements Based on Stage Length

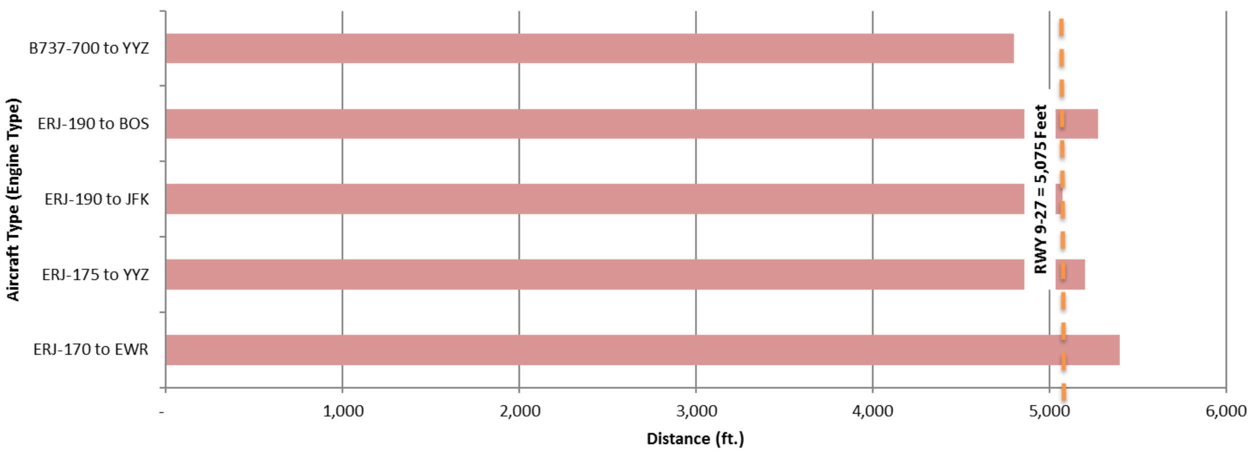
Exhibit 4.1-9 presents the required takeoff runway length required to reach approximately a 1,100 to 1,200 nm stage length (such as a departure for EWR, JFK, ORD, YYZ, and BOS), on a hot day (30° C, i.e. 86° F), at the takeoff weight required for this range with a 100 percent load factor.

As shown, the ERJ-170, ERJ-175, and ERJ-190 require more runway than available to take off on Runway 9-27 with a full load of passengers to reach a destination between 1,100 nm and 1,200 nm from EYW:

- 5,400 feet for the ERJ-170 (EYW to EWR)
- 5,275 feet for the ERJ-190 (EYW to BOS)
- 5,200 feet for the ERJ-175 (EYW to YYZ)
- 5,075 feet for the ERJ-190 (EYW to JFK)

[6] Florida Climate Center, *Key West International Airport, 30 Year Daily Temperature and Precipitation Normals 1981-2010*, https://climatecenter.fsu.edu/products-services/data/1981-2010-normals/key-west (accessed September 2016.).

Exhibit 4.1-9: Takeoff Distance Requirements for 1,100/1,200-nm Stage Length



Notes:

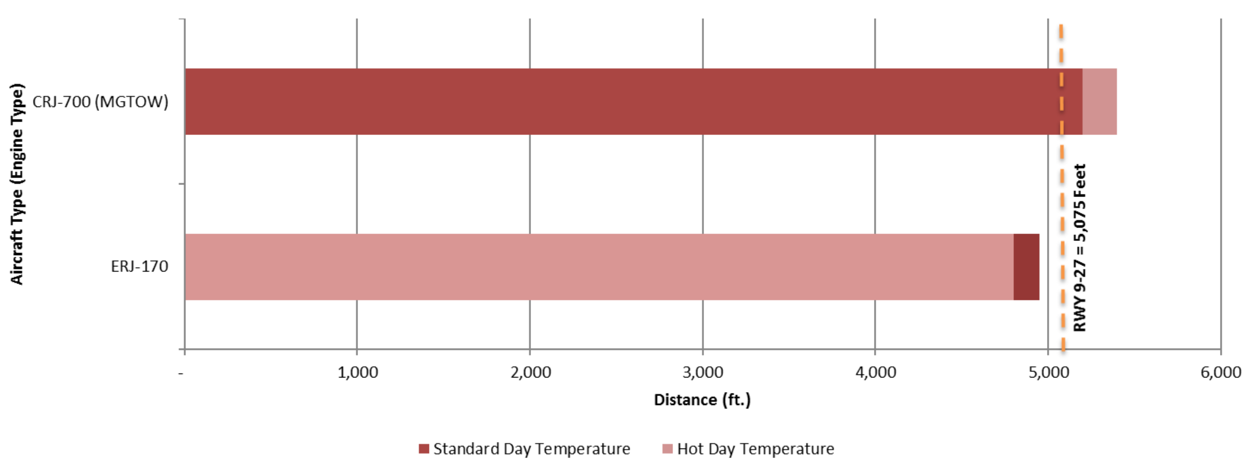
1/ Typical airway routing in Nautical Air Miles based on 85% Annual Enroute Winds

2/ Assumes a passenger +bag weight of 228 lbs per person

SOURCE: Ricondo & Associates, Inc., September 2016 (Aircraft Performance Manuals); Flight Engineering, LLC., February 2019
PREPARED BY: Ricondo & Associates, Inc., November 2016.

Exhibit 4.1-10 presents the required takeoff runway length required to reach approximately a 900-nm stage length (such as a departure for Washington, D.C.), on both a standard temperature day (15° C, i.e. 59° F) and a hot day (30° C, i.e. 86° F), at the takeoff weight required for this range with a 100 percent load factor. This information is presented as a bar graph reflecting the takeoff runway length required for the aircraft anticipated to operate from EYW through 2035.

Exhibit 4.1-10: Takeoff Distance Requirements at Maximum Allowable Takeoff Weight for 900-nm Stage Length

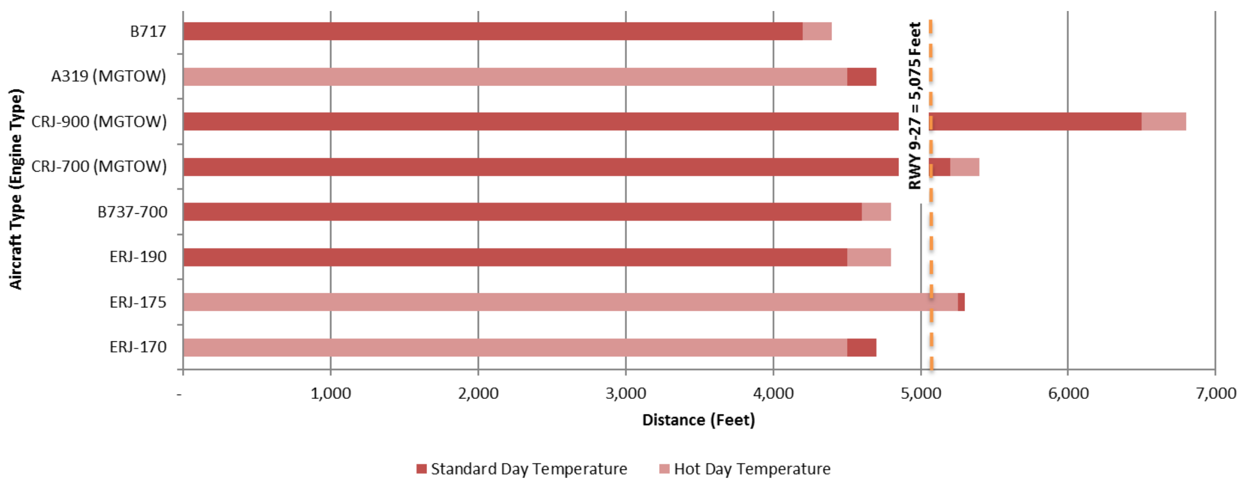


SOURCE: Ricondo & Associates, Inc., September 2016 (Aircraft Performance Manuals).
PREPARED BY: Ricondo & Associates, Inc., September 2016.

As shown, the ERJ-170 could take off on Runway 9-27 with a full load of passengers and reach a destination approximately 900 nm from EYW on a hot day. It should be noted that the runway length required on a standard day is greater than the one required on a hot day. Also, this analysis was performed for the CRJ-700 assessed at maximum gross takeoff weight (MGTOW) because of the inability to quantify the runway length requirements for a specific stage length using the performance data contained in the aircraft planning manuals published by Bombardier.

Exhibit 4.1-11 presents the required takeoff runway length required to reach approximately a 650-nm stage length (such as a departure for Charlotte, NC or Atlanta, GA), on both a standard temperature day (15° C, i.e. 59° F) and a hot day (30° C, i.e. 86° F), at the takeoff weight required for this range with a 100 percent load factor. This information is presented as a bar graph reflecting the takeoff runway length required for the aircraft anticipated to operate from EYW through 2035.

Exhibit 4.1-11: Takeoff Distance Requirements at Maximum Allowable Takeoff Weight for 650-nm Stage Length



SOURCE: Ricondo & Associates, Inc., September 2016 (Aircraft Performance Manuals).
PREPARED BY: Ricondo & Associates, Inc., September 2016.

It should be noted that this analysis was performed for the CRJ-700, CRJ-900, and A319 assessed at MGTOW because of the inability to quantify the runway length requirements for a specific stage length using the performance data contained in the aircraft planning manuals published by Bombardier and Airbus.

As shown, the B717, B737-700, A319, ERJ-170 and ERJ-190 could take off on Runway 9-27 with a full load of passengers and reach a destination approximately 650 nm from EYW on a hot day. The ERJ-175 requires slightly more runway than available to take off: 5,250 feet on a standard day and 5,200 feet on a hot day. The CRJ-700 and CRJ-900 require more runway than available to take off: 5,200 feet on a standard day and 5,400 feet on a hot day for the CRJ-700; 6,500 feet on a standard day and 6,800 feet on a hot day for the CRJ-900.

Conclusion

To serve the furthest markets with minimum or no payload restrictions, a takeoff runway length between 5,200 feet and 5,400 feet would be required. It is recommended that Runway 9-27 be extended by a minimum of 200 feet to provide 5,275 feet of usable length for departures. This would allow the airlines that operate at the Airport to serve Boston, New York, and Toronto without any weight restrictions. Without a runway extension, certain types of aircraft may only be operated with payload restrictions (typically with less than a full load of passengers) when departing from EYW.

Runway Width

The FAA has determined runway width requirements based upon the critical aircraft's approach speed and wingspan. The various widths provide a certain margin of error to account for wind effects on aircraft landing and taking off. Referencing the FAA AC 150/5300-13A (Change 1), the standard runway width of a C-III runway is 150 feet wide. Although Runway 9-27 has a width of 100 feet, according to the aforementioned AC, it is acceptable for the runway to be 100 feet wide if the critical aircraft has a maximum take-off weight of less than 150,000 pounds.

Runway Pavement Strength

As mentioned in Section 2.2.1, Runway 9-27 has pavement strengths of 75,000 pounds for single-wheel landing gears, 125,000 pounds for dual-wheel landing gears, and 195,000 pounds for dual-tandem wheel landing gears. These pavement conditions are suitable for all aircraft types presently operating and anticipated to operate at EYW within the planning horizon.

Runway Pavement Conditions

As indicated in the FDOT's *Pavement Evaluation Report*, and highlighted on Exhibit 2-4, the PCI[7] of Runway 9-27 average is 76, indicating that the runway is in good condition. While no major pavement rehabilitation is anticipated in the short-term, Monroe County should continue conducting regular pavement repairs, such as crack sealing, when needed. Although this should be sufficient maintenance to uphold the integrity of the runway, rehabilitation of the runway will most likely be necessary in the long-term.

Runway Shoulder Width

Currently, Runway 9-27 has 10 feet of paved shoulders in lieu of the 25 feet paved shoulders that are required for a standard C-III runway. However, according to Table 3-5: *Runway Design Standard Matrix*, footnote 12 in AC 150/5300-13A (Change 1): "For airplanes with maximum certificated takeoff weight of 150,000 lbs or less, the standard runway width is 100 feet, the shoulder width is 20 feet, and the runway blast pad width is 140

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[7] The pavement condition index (PCI) is a numerical rating of the pavement condition that ranges from 0 to 100, with 0 being the worst possible condition and 100 being the best possible condition. However, the correlation between the pavement age and PCI values is not linear. The deterioration of the runway accelerates towards the end of the estimated life of runway pavement.

feet."[8] An additional 10 feet of shoulder pavement will be required to meet this standard and should be analyzed during future runway improvements.

Runway Blast Pads

The FAA AC *Airport Design* recommends that runways serving aircraft with an ARC of C-III have blast pads located at each runway end. These areas are paved, but they are not usually constructed of full-strength pavement. They serve to reduce erosion caused by jet blast produced upon aircraft takeoff. Blast pad dimensions for ADG III aircraft are 95 feet wide by 150 feet long (140 feet long for airplanes with maximum certificated takeoff weight of 150,000 pounds or less). The Runway 27 end has an EMAS bed that serves the purposes of a blast pad. The Runway 9 end is planned to be extended to the edge of the EMAS, which will then also serve the purposes of a blast pad.

Runway-to-Taxiway Separation Distance

The FAA's design standards for runway-to-taxiway separation distances ensure that aircraft can safely operate on parallel taxiways without encroaching the runway safety area, obstacle free zone, runway protection zone, or navigational aids critical areas. For a C-III runway, the FAA requires a 400-foot separation between the runway centerline and the parallel taxiway centerline. The existing runway centerline to the Taxiway A centerline separation is 315 feet. Taxiway A currently does not meet the FAA required separation because of the limited amount of land the Airport has available. Additionally, the existing airfield is surrounded by bodies of water on three sides.

4.1.2.4 Runway Areas

The FAA's design standards for the various runway areas at EYW are presented in this section. The following is a list of the airfield safety areas that were evaluated for the Airport:

- RSAs
- Runway Object Free Areas (ROFAs)
- Obstacle Free Zones (OFZs)
- Runway OFZs
- RPZs

The existing Airport Layout Plan (ALP) was used to determine the locations of objects that may affect navigation. The existing runway area deficiencies are illustrated on Exhibit 4.1-8 and are described in more detail in the following subsections.

Runway Safety Area

RSAs are rectangular areas centered on runway centerlines, which, under normal (dry) conditions, are capable of supporting aircraft without causing structural damage to the aircraft or injury to its occupants, should an

8 Federal Aviation Administration, AC 150/5300-13A, *Airport Design* (Change 1), February 2014.

aircraft inadvertently leave the paved runway surface. To serve this function, the FAA requires RSAs to be: (1) cleared and graded, (2) drained by grading or storm sewers to prevent water accumulation, and (3) free of objects, except those that need to be located in the RSA because of their function (e.g., approach lighting, other NAVAIDS).

Based on the FAA design standards for C-III runways, the RSA for the existing runway should be 500 feet wide and extend 1,000 feet beyond the runway ends. The existing RSA (length and width) does not currently meet these standards. In 2011, the Airport underwent a Runway Safety Area Improvements project to maximize the RSA to the extent practicable due to the surrounding salt ponds. EMAS beds were installed on both ends to mitigate the RSA length issues to the extent practicable. Options to meet the FAA runway C-III safety area design standards will be evaluated as part of the Runway Safety Area analysis currently underway and scheduled to be completed mid-2017.

Runway Object Free Area

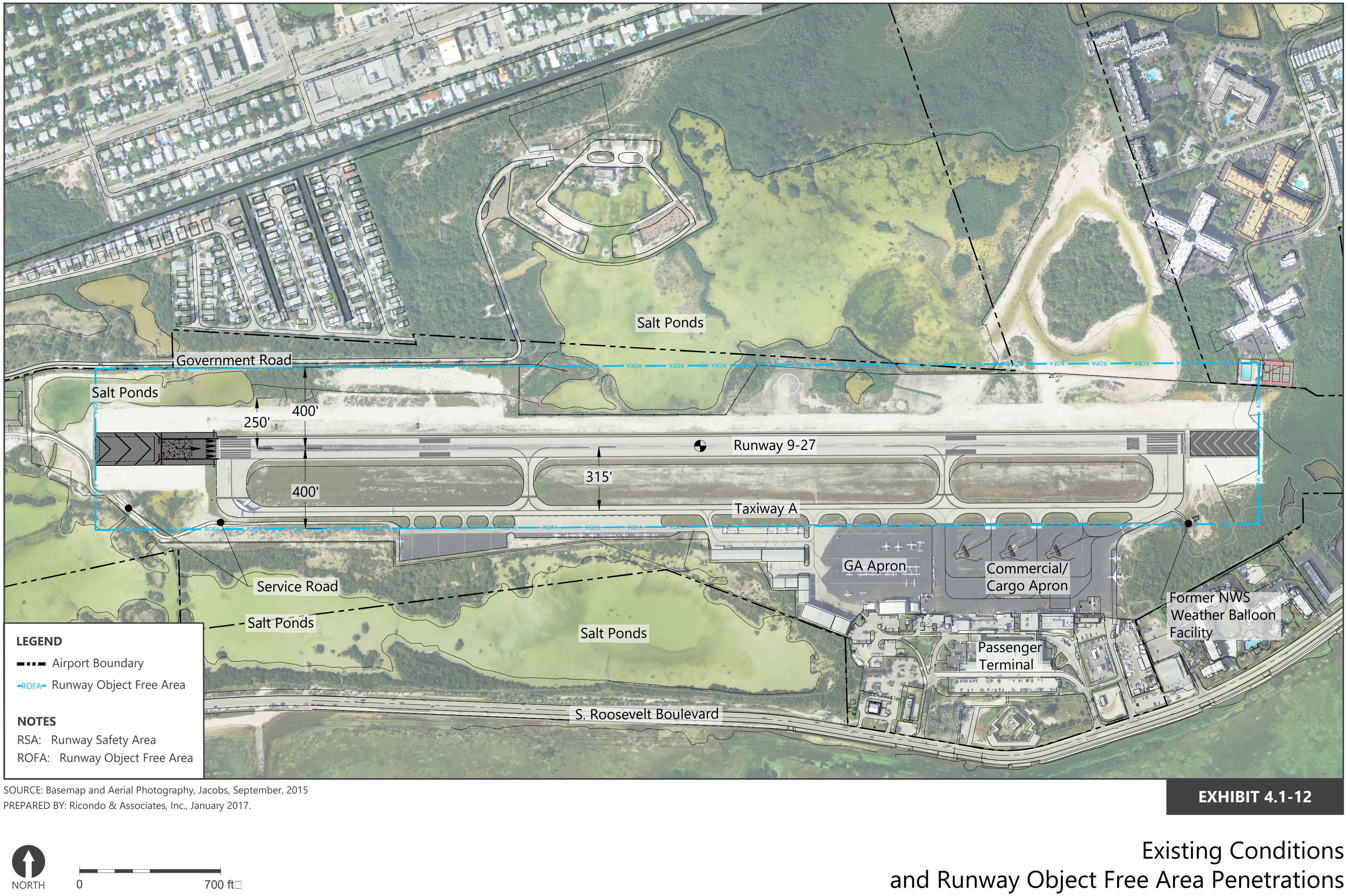
ROFAs are rectangular areas centered on runway centerlines that are required to be clear of objects protruding above the RSA edge elevation, with the exception of those objects that are essential to air navigation or to aircraft ground maneuvering. Objects that are nonessential for either air navigation or aircraft ground maneuvering are not permitted within the ROFA. For runways serving ARC C-III aircraft, ROFAs must be 800 feet wide (i.e., 400 feet on either side of the runway centerline) and extend 1,000 feet beyond the end of the runway or stopway.

The existing ROFA length is the same as the RSA, which extends to the end of the EMAS beds on either runway ends. **Exhibit 4.1-12** identifies non-essential objects inside the limits of the C-III ROFA: on-Airport vehicle service road, Airport property fence, off-Airport private tennis courts and swimming pool, and the former National Weather Station (NWS) balloon launch facility.

Obstacle Free Zone

The OFZs are three-dimensional volumes of airspace that support the transition of ground to airborne aircraft (and vice-versa). The OFZ clearance standards established by the FAA prohibit taxiing and parking aircraft or locating other objects where they would penetrate this airspace, except frangible NAVAIDS or fixed-function objects. The OFZ consists of the airspace up to 150 feet above the established airport elevation and along the runway and extended runway centerline. The OFZ can be further categorized as inner-approach OFZs and inner-transitional OFZs.

The required runway OFZ for runways serving aircraft in excess of 12,500 pounds is typically 400 feet wide and extends 200 feet beyond each end of the runway. The OFZs for the existing runway meet current FAA standards. Currently, the only objects within the runway OFZs are NAVAIDS, which are required to be located there because of their function.



SOURCE: Basemap and Aerial Photography, Jacobs, September, 2015
PREPARED BY: Ricondo & Associates, Inc., January 2017.

EXHIBIT 4.1-12

Existing Conditions
and Runway Object Free Area Penetrations

Drawing: P:\Project-Chicago\EYW\On-Call\2-ROFA MOS\CAD\Ex 1_Existing Conditions ROFA.dwgLayout: Ex1_ROFA Plotted: Mar 6, 2019, 09:31AM

Runway Protection Zone

The RPZ is a trapezoidal area centered on the extended runway centerline. The length and width of the RPZ are contingent on the size of the aircraft operating on the runway, as well as the type of approach (e.g., visual, instrument) and approach minimums available. As a result, the criteria for the RPZ may vary for each end. RPZs are designed to enhance the protection of people and property on the ground. To achieve this goal, the FAA recommends that the airport operator owns the property inside the RPZ. This area should be free of land uses that create glare and smoke. Also, the FAA recommends that airport operators keep the RPZs clear of incompatible land uses, specifically residences, fuel storage facilities, and places of public assembly (e.g., churches, schools, office buildings, and shopping centers). Typically, a single RPZ is associated with each runway end; however, the FAA has suggested that separate approach and departure RPZs be defined for any runway end with a displaced arrival threshold.

Since the previous Master Plan and ALP were completed, the critical aircraft and ARC have changed, as well as the instrument approach procedures. As such, the RPZs depicted on the current ALP are outdated. RPZ dimensions for C-III aircraft are provided in **Table 4.1-11**, which is based on instrument approach visibility minimums.

Table 4.1-11: Runway Protection Zone Dimensions for C-III Aircraft

	VISIBILITY MINIMUMS	
	NOT LOWER THAN 1 MILE (RUNWAY 9 END)	NOT LOWER THAN ¾ MILE (RUNWAY 27 END)
Approach RPZ	500' x 1,010' x 1,700'	1,000' x 1,510' x 1,700'
Departure RPZ	500' x 1,010' x 1,700'	500' x 1,010' x 1,700'

SOURCE: Federal Aviation Administration, Advisory Circular 150/5300-13A, *Airport Design* (Change 1), February 2014.
PREPARED BY: Ricondo & Associates, Inc., July 2016.

The Runway 9 end RPZ has approach visibility minimums not lower than 1 mile, while the Runway 27 end RPZ has approach visibility minimums not lower than three-quarter miles. **Exhibit 4.1-13** depicts these RPZs and highlights incompatible land uses, such as buildings and roadways. Since the RPZ dimensions increased on the Runway 27 end, coordination with the FAA will be required to determine if these land uses can remain inside the RPZ; an RPZ Alternatives Analysis report should document mitigation alternatives and associated impacts and be submitted to the FAA for review.

Since the RPZ extends beyond the existing property limits, it is also recommended that Monroe County acquire fee title to all land within the RPZ and/or acquire navigation easements that adequately restrict current and future use of the land surface to preclude incompatible uses and convey the following: the right of flight with inherent noise and vibration below the approach surface, the right to remove obstructions encroaching existing and future approach surfaces, and a restriction against the establishment of future obstructions.

SOURCE: Jacobs, September 2015 (Basemap and Aerial Photography).
PREPARED BY: Ricondo & Associates, Inc., January 2017.

NORTH 0 00 ft

EXHIBIT 4.1-13

Existing Runway Protection Zones and Incompatible Land Uses

Drawing: :\EYW\2015 Master Plan\4-Facility Requirements\Airfield Geometry\CAD\Exhibit 4.1-12_RP based on C-.dwgLayout: 11x17L Plotted: Jan 20, 2017, 0:21AM

4.1.2.5 Taxiway Geometry

The existing airport taxiways serve as routes for aircraft to maneuver to and from various portions of the Airport. FAA taxiway design standards are determined by ADG and TDG for the critical aircraft. An assessment of taxiway geometry principles and dimension standards was conducted, based on guidance set forth in FAA AC 150/5300-13A, *Airport Design*, for ADG III and TDG 3 aircraft. The existing taxiway geometry deficiencies are illustrated on Exhibit 4.1-8 and are described in more detail in the following subsections.

Wide Expanse of Pavement

Both Taxiways B and E are runway entry taxiways with wide expanses of pavement.

Direct Access from Apron to Runway

Taxiways C and D provide direct access from the apron to the runway.

Taxiway Fillets

All Taxiway A connectors into the apron need wider pavement/fillets to allow cockpit over centerline taxiing.

4.1.3 AIRCRAFT APRON

The following issues were identified by Airport staff and should be evaluated in the Alternatives Development section:

- The need to identify areas for the staging of GSE
- Passenger and vehicle circulation on the ramp and the need to evaluate whether the installation of a passenger boarding bridge could improve the level of service at the Airport
- The existing aircraft ramp layout and the need to maximize the number of aircraft parking positions in front of the passenger terminal, including power in/power out taxiing
- The proximity of the GA and commercial aircraft ramps and the need to preserve the integrity of the SIDA
- The need to evaluate the existing taxiway layout, including the departure taxiway routes and the access points between the existing and proposed apron and the runway
- The accommodation of large GA aircraft, including business jets on the ramp and possible encroachments into the existing Taxiway A safety areas

4.1.4 INSTRUMENT APPROACHES

There are two RNAV/GPS approaches at EYW, one to each runway end, as well as an NDB approach (circling only) and a radar approach. The instrument approaches available at EYW are considered adequate, and no significant upgrades to instrument approach procedures are planned.

4.1.5 AIRFIELD LIGHTING

Airports are required to install and maintain multiple airfield lighting systems, as noted in 14 CFR Part 139. The rotating beacon serves as a visual indicator of the Airport's location. The beacon at EYW is located south of the ARFF facility. The rotating beacon is reported to be fair condition. The beacon was installed in the summer of 1990 and the tower portion is in good shape. However, the light housing and mechanics should be refurbished or replaced in the next 5 to 10 years based on its current reported condition and the FAA's typical useful life.

Runway 9-27 and taxiway A are both equipped with medium intensity lighting systems for night operations and restricted visibility.

The runway lighting system is reported to be in good working order. However, the taxiway edge lighting system and associated circuits are reaching the end of their serviceable life. All of this equipment is scheduled to be replaced concurrently with the rehabilitation of the taxiways.

4.1.6 AIRFIELD SIGNAGE

While the existing airfield signage is adequate, given the level of activity at the Airport, additional location, direction, and runway holding signs could be added in order to provide additional guidance to pilots on the airfield.

Throughout the planning period, existing signage should be maintained in proper working order. Additionally, as other airfield pavement projects are conducted, new signage should be installed that meets FAA design criteria. The types and number of new signs that are likely to be required during the planning period will depend upon the selected development alternatives.

4.1.7 PAVEMENT MARKINGS

Airport pavements are marked with painted lines and numbers in order to aid in the identification of the runways from the air and to provide information to the pilot during the approach phase of flight. There are three standard sets of markings used, depending on the type of runway:

- Basic: For runways with only visual or circle-to-land procedures. These markings consist of runway designation markers and a centerline stripe.
- Nonprecision: For runways to which a straight-in, nonprecision instrument approach has been approved. These markings consist of runway designation markers, a centerline stripe, and threshold markings.
- Precision: For runways with a precision instrument approach. These markings consist of the nonprecision markings, plus aiming point markings, touchdown zone stripes, and side stripes indicating the extent of the full strength of the pavement.

Depending on the type of aircraft activity and physical characteristics of the pavement, additional markings may be required for any of the three categories of markings. Runway pavement and displaced threshold markings are painted white, while taxiway pavement markings are painted yellow.

A description of the existing markings on airfield pavement areas was provided in Section 2. All areas have the appropriate markings for the existing conditions. For example, both the Runway 9 and Runway 27 ends have nonprecision approach markings. All taxiways are marked with centerline markings.

All runway and taxiway markings periodically need to be remarked in order to remain visible to the users of the Airport. As future pavement improvements are made, airfield markings should be included that comply with FAA AC 150/5340-1L, *Standards for Airport Markings*.

4.1.8 VISUAL LANDING AIDS

The runway ends are equipped with four-box PAPI lighting systems that provide aircraft with a visual descent reference during approach. As indicated on Exhibit 2-3, the PAPIs are located on the left side of each runway end. In addition, both runway ends are equipped with REIL. The REILs consist of two synchronized flashing lights, located on each side of the runway threshold, that provide rapid and positive identification of the runway end. Throughout the planning period, existing visual landing aids should be maintained in proper working order. However, no additional visual landing aids are anticipated at the Airport.

4.1.9 WIND DIRECTION INDICATORS

The lighted segmented circle and wind cone is in good condition. No improvements are recommended to the existing system, beyond normal maintenance.

4.1.10 SUMMARY OF RECOMMENDED IMPROVEMENTS

The following improvements are recommended to meet FAA design standards:

- An additional 200 feet of runway length to provide 5,275 feet of usable length for departures
- An additional 10 feet of shoulder pavement on either side of the runway
- For a C-III runway, the FAA requires a 400-foot separation between the runway centerline and the parallel taxiway centerline—further analysis required and/or Request for Modification of Standards (MOS)
- RSA length and width improvements and/or request for MOS
- ROFA length and width improvements and/or request for MOS

RPZ penetrations require coordination with FAA (an RPZ Alternatives Analysis report should document mitigation alternatives and associated impacts and be submitted to the FAA for review.)

4.2 Passenger Terminal

This section describes the facilities that are needed to support the passenger activities through the planning period, including the unique purpose of each terminal function. In general, this section discusses the location of the main terminal facilities, such as public and nonpublic facilities used by passengers, airlines, other tenants, Monroe County, and other agencies.

The facilities and space requirements that are described in this section represent the basis for forming the preferred terminal development plans. The terminal space requirements set forth in this section do not themselves constitute a facility program, as they do not address program considerations, such as potential constraints imposed by the site, environmental considerations, or implementation strategies. The requirements do not address airport areas such as restrooms, MEP, and circulation, since these are typically based on concept development or local building codes.

4.2.1 PLANNING ACTIVITY LEVELS

Each airport has its own distinct characteristics due to differences in airline schedule, the percentage of business travelers, and the mix of origin and destination passengers versus transfer passengers. For the purpose of identifying future facility requirements, design day activity schedules were developed to represent aircraft movements and passenger traffic distribution throughout the hours of the day. These design schedules have been utilized for other demand capacity analyses as part of this Master Plan Update.

The DDFS represent the anticipated flight activities at the Airport for design years 2020, 2025, and 2035. The DDFS included flight-by-flight data, such as load factors and origination/destination shares. **Table 4.2-1** summarizes and compares key metrics from each DDFS pertaining to peak hour levels for flight operations, as well as for arriving and departing passengers. **Exhibit 4.2-1** illustrates the diurnal levels of originating and departure passengers at their scheduled time of departure. The exhibit indicates that the peak hour activity level for originating passengers occurs between 11:00 a.m. and 12:00 p.m. for all forecast DDFS.

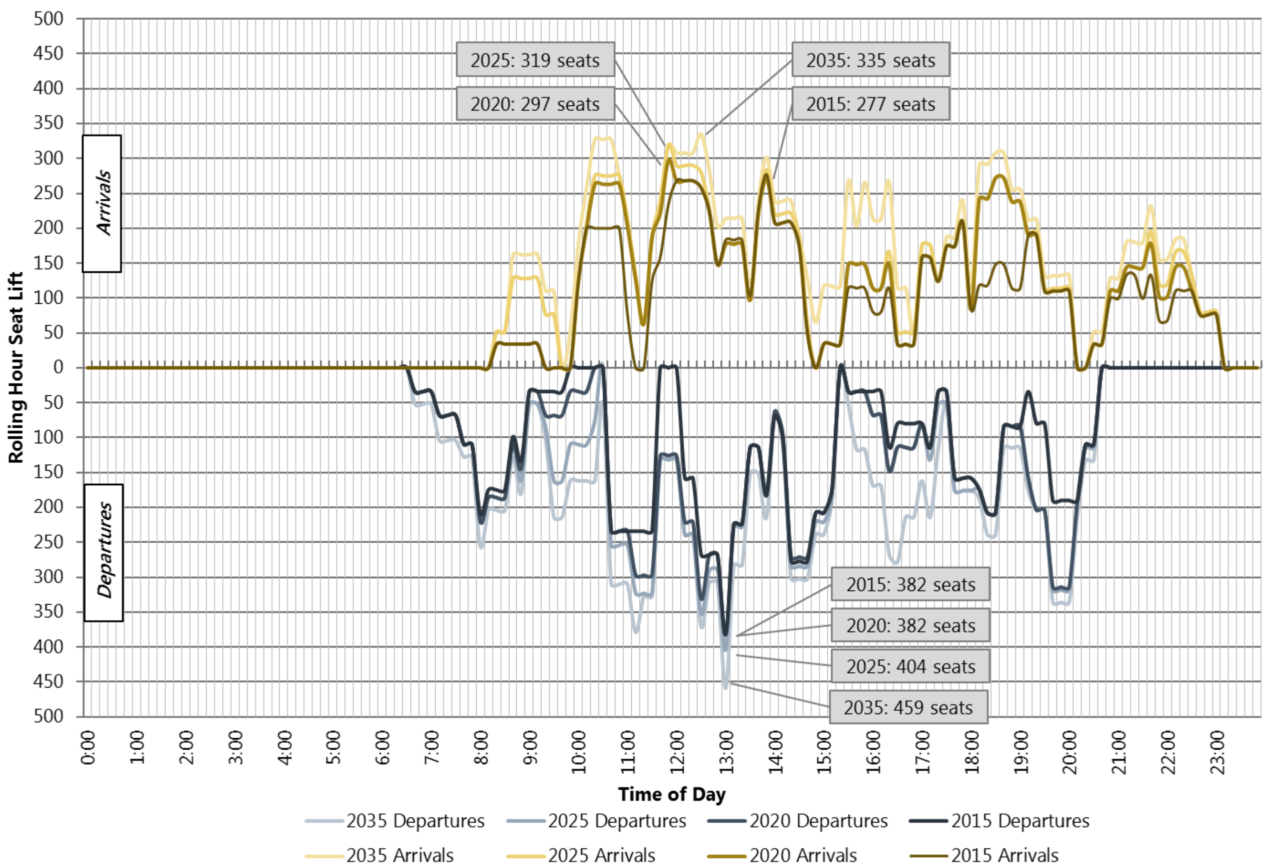
A DDFS was developed for each of the design years by comparing the forecast annual growth and applying this growth to the current flight schedule.

Table 4.2-1: Design Day Flight Schedule Metrics

DAILY	UNITS	2015	2020	2025	2035
Departures					
Aircraft Operations	operations	28	33	34	37
Seats	passengers	1,716	2,039	2,216	2,683
Enplaned Passengers	passengers	1,312	1,568	1,757	2,096
Originating Passengers	passengers	1,308	1,562	1,752	2,090
Arrivals					
Aircraft Operations	operations	28	33	34	37
Seats	passengers	1,716	2,039	2,224	2,687
Deplaned Passengers	passengers	1,232	1,466	1,646	1,969
Terminating Passengers	passengers	1,227	1,458	1,639	1,960
PEAK HOUR					
Departures					
Aircraft Operations	operations	6	6	6	6
Seats	passengers	382	382	404	459
Enplaned Passengers	passengers	292	301	324	361
Originating Passengers	passengers	290	299	323	359
Arrivals					
Aircraft Operations	operations	5	5	5	5
Seats	passengers	277	297	319	335
Deplaned Passengers	passengers	213	207	225	262
Terminating Passengers	passengers	212	207	223	260
Overall					
Aircraft Operations	operations	**56**	**66**	**68**	**74**

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Exhibit 4.2-1: Diurnal Passenger Activity Levels



SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

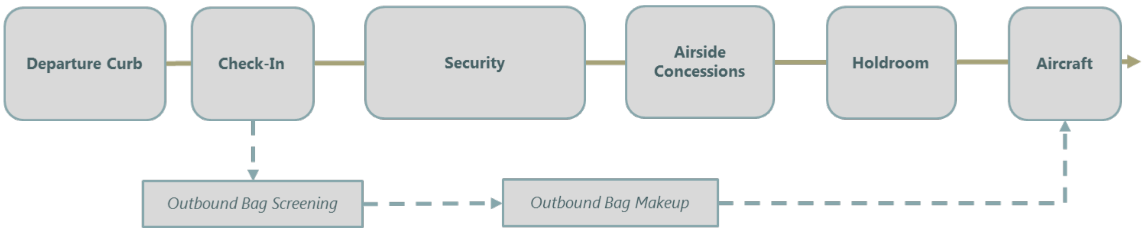
4.2.2 PLANNING BASIS

This section describes the planning basis used to determine future terminal facility requirements. The planning basis includes: passenger processing sequences, terminal operating parameters, and passenger attributes, which were intended to be specific to EYW. Sources used to develop the planning basis included: site observations made by team member traveling to EYW; data collected at comparable airports; and industry published guidelines representing best practices pertaining to processing rates and level of service.

4.2.2.1 Passenger Processing Sequence

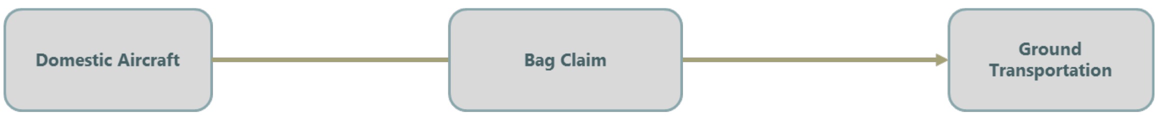
Exhibit 4.2-2 and **Exhibit 4.2-3** illustrate typical passenger processing sequences for originating (departing) passengers and destination (terminating) passengers.

Exhibit 4.2-2: Originating Passenger Flows



SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Exhibit 4.2-3: Destination Passenger Flows



SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.2.2.2 Level of Service Standards

Level of Service (LOS) standards define key performance objectives for passenger transaction wait times and the amount of space provided to passengers waiting in queue. **Table 4.2-5** lists the LOS standard framework for the design of terminal facilities, as recommended by the International Air Transport Association (IATA) in its *Airport Development Reference Manual* (10th ed.). The following categories comprise the LOS:

- **Overdesign (A/B):** facilities resulting in underutilized spaces with nearly no delays; high maintenance and construction cost relative to facility utilization.
- **Optimum Design (C):** facilities that provide adequate space and reasonable delays; cost of maintenance and construction is equitable to facility utilization.
- **Suboptimum Design (D):** a facility that meets one but not both space and time LOS variables; facility should consider improvements.
- **Suboptimum Design (E):** facilities resulting in breakdown with unacceptable delays; strongly suggest improvements to an over-utilized facility.

The specific LOS standards used for individual processors and functional areas are identified in the following description of operating parameters.

Table 4.2-5: International Air Transport Association Level-of-Service Space-Time Framework

PASSENGER TERMINAL PROCESSOR	NOTES	SPACE STANDARDS FOR WAITING AREAS			WAITING TIME STANDARDS FOR PROCESSING FACILITIES						PROPORTION OF SEATED OCCUPANTS		
UNITS		(ft²/pax)			Economy Class (min)			Business Class/First Class (min)			(%)		
ADRM 9th Edition		A B	C	D E	A B	C	D E	A B	C	D E	A B	C	D E
ADRM 10th Edition		Over Design	Optimum	Suboptimum	Over Design	Optimum	Suboptimum	Over Design	Optimum	Suboptimum	Over Design	Optimum	Suboptimum
Public Departure Hall		>24.8	24.8	<24.8									
Check-in													
Self-Service Boarding	pass/tagging	>19.4	14.0-19.4	<14.0	<0	0-2	>2	<0	0-2	>2			
Bag Drop Desk	queue width 1.4-1.6 m or 4.5-5.0 ft	>19.4	14.0-19.4	<14.0	<0	0-5	>5	<0	0-3	>3			
Check-in Desk	queue width 1.4-1.6 m or 4.5-5.0 ft	>19.4	14.0-19.4	<14.0	<10	10-20	>20	Business <3	3-5	>5			
	queue width 1.4-1.6 m or 4.5-5.0 ft	>19.4	14.0-19.4	<14.0	<10	10-20	>20	First <0	0-3	>3			
Security Checkpoint	queue width 1.2 m or 4 ft	>12.9	10.8-12.9	<10.8	<5	5-10	>10	Fast Track <0	0-3	>3			
Boarding Gate Lounge													
Seating		>18.3	16.2-18.3	<16.2							>70%	50%-70%[1]	<50%
Standing	see notes below	>12.9	10.8-12.9	<10.8									
Baggage Claim Area													
Narrow Body	Priority bags to be delivered before Economy	>18.3	16.2-18.3	<16.2	<0	0-15	>15	0	0-15	>15			
Public Arrival Hall		>18.3	12.9-18.3	<12.9							>20%	15%-20%	<15%
CIP Lounge			43.0										

NOTES:

CIP – Commercially Important Passengers

1/ The lower limit is only to be considered if extensive Food and Beverage F&B is provided in the departures lounge or concession zone seating available.

SOURCE: International Air Transport Association, *Airport Development Reference Manual*, 10th ed., March 2014.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

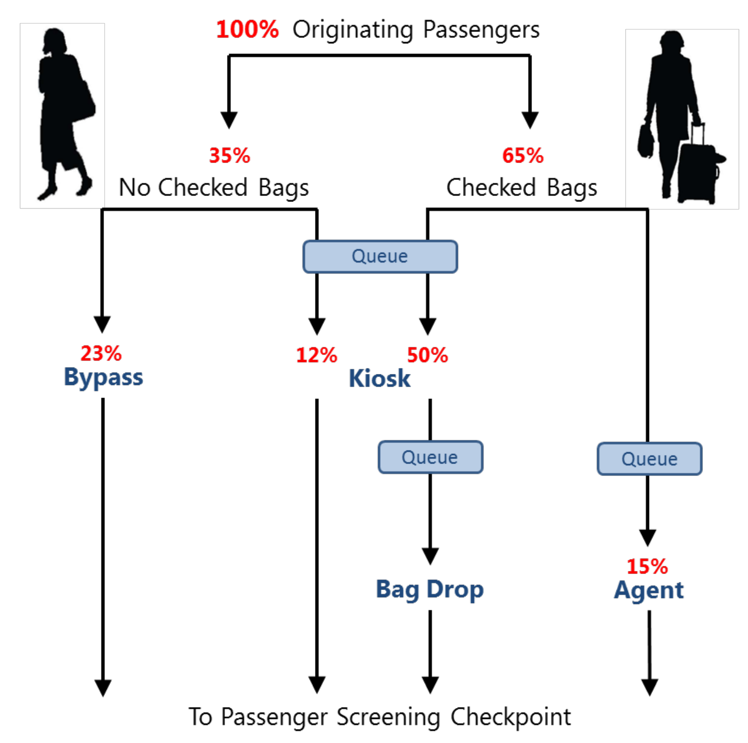
4.2.2.3 Operating Parameters

Check-in

Exhibit 4.2-5 illustrates check-in channel preferences for departing passengers. The rates are based on industry standards and data collected at other airports, since no onsite observations were conducted. Passengers were offered different check-in options, which included full-service counters or a combination of check-in kiosks and bag-drop counters:

- Full-service agent positions—Full-service agents' positions were prioritized to passengers with bags, passengers needing special assistance, such as minors travelling alone, and premium passengers.
- Check-in kiosks (boarding pass and/or self-tag)—The majority of passengers were encouraged to use the kiosk check-in process. Kiosks in the check-in lobby could be used by passengers to acquire boarding passes and baggage tags, whereas kiosks located in other locations, such as the pedestrian bridge or adjacent to the security checkpoint, could only be used by passengers to acquire boarding passes.
- Bag-drop counters—Passengers who are checking bags self-tag their check-in baggage at kiosks and drop them at agent-staffed bag-drop counters.

Exhibit 4.2-4: Check-In Channel Preferences



SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Table 4.2-6 lists the transaction times and wait times corresponding to desired level service standards for passengers using in-terminal check-in facilities.

Table 4.2-6: Check-In Transaction Times and Level of Service Wait Times

NO CHECKED BAGS		
	WAIT TIME	**TRANSACTION TIME**
Bypass	N/A	N/A
Kiosk	2 minutes	3 minutes
CHECKED BAGS		
	WAIT TIME	**TRANSACTION TIME**
Kiosk	2 minutes	3.5 minutes
Bag Induction	4 minutes	1 minute
Agent	15 minutes	3 minutes

NOTE:

N/A – Not Applicable

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Passenger Security Screening Checkpoint

Table 4.2-7 lists the operating parameters for Transportation Security Administration (TSA) screening checkpoints. The analysis used screening rates for standard screening and Pre✓ that are consistent with TSA guidelines for new checkpoints. The percentage of passengers eligible to use Pre✓ was based on average TSA data.

Table 4.2-7: Passenger Security Screening Checkpoint Screening Rates and Level of Service Wait Times

CHECKPOINT TYPE	PERCENTAGE	WAIT TIME	PROCESSING RATE
Pre✓	30%	5 min	250 passengers/hour
Standard	70%	10 min	150 passengers/hour

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Holdrooms

Holdrooms consist of the preboarding areas adjacent to aircraft gates, which are used for passenger seating and standing, airline agent check-in podiums, and boarding/deplaning queuing spaces and aisles. Holdroom requirements are based on the predominant or largest aircraft supported by the holdroom. For this analysis, requirements for holdrooms were developed based on peak hour passenger demand at scheduled time of departure and peak hour number of gates required. **Table 4.2-8** lists other planning factors that were applied to the respective aircraft seating capacities in order to develop the individual holdroom space requirements to support a gate.

Table 4.2-8: Holdroom Planning Criteria

PLANNING FACTORS	UNITS	VALUE	SOURCE
Adjoining holdroom credit	percent	0.9	Airport Cooperative Research Program
Agent counter area 1/	square feet	120.0	Airport Cooperative Research Program
Agent counter positions	positions	2.0	Airport Cooperative Research Program
Aisleway 2/	square feet	180.0	Airport Cooperative Research Program
Aisleway	row	1.0	Airport Cooperative Research Program
Holdroom Calculation 3/			
Seated	percentage	60.0	International Air Transport Association
Standing	percentage	20.0	International Air Transport Association
Seated	square feet	18.0	International Air Transport Association
Standing	square feet	12.0	International Air Transport Association
Queuing	square feet	11.0	International Air Transport Association

NOTES:

1/ Based on 4 feet wide by 30 feet deep.

2/ Based on 6 feet wide and 30 feet deep.

3/ Based on 40 percent seated, 30 percent standing, and 30 percent queuing.

SOURCES: Airport Cooperative Research Program, Report 25, *Air Passenger Terminal Planning and Design,* Vol. 1, *Guidebook,* 2010. International Air Transport Association, *Airport Development Reference Manual*, 10th ed., March 2014.

PREPARED BY: Ricondo & Associates, Inc., September 2016.

Outbound Baggage Makeup

Outbound baggage makeup facility requirements principally pertain to the number and capacity of baggage makeup devices (typically bag carousels, piers, or slides) that receive and accumulate checked bags prior to being loaded onto baggage carts or containers for delivery to outbound aircraft. Bags accumulated on makeup devices have cleared TSA Hold Bag Screening. **Table 4.2-9** lists the criteria used to determine outbound baggage makeup facility requirements, which, for this analysis, were developed in terms of the linear feet of cart staging positions used for flight makeup during the period beginning 120 minutes and ending 30 minutes before scheduled time of departure.

Table 4.2-9: Outbound Baggage Makeup Planning Criteria

OUTBOUND BAGGAGE MAKEUP	UNITS	VALUE	SOURCE
Linear Feet per Cart	feet	6.0	Airport Cooperative Research Program
Overall Bags per Passenger	ratio	0.7	Ricondo & Associates, Inc.
Bags per Cart	bags	40.0	Airport Cooperative Research Program
Cart Close-out Time	minutes	30.0	Airport Cooperative Research Program

SOURCES: Airport Cooperative Research Program, Report 25, *Air Passenger Terminal Planning and Design,* Vol. 1, *Guidebook,* 2010;
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Baggage Claim

Domestic baggage claim capacity is principally determined by the amount of retrieval area, which is defined as a 12-foot band surrounding a baggage claim device that is provided for passengers waiting to claim their checked bags. The analysis is predicated on last bag delivery occurring within 20 minutes of flight arrival. **Table 4.2-10** lists the criteria used to determine the requirements for the domestic baggage claim.

Table 4.2-10: Domestic Baggage Claim Planning Criteria

DOMESTIC BAGGAGE CLAIM	UNITS	VALUE	SOURCE
Last Bag Delivery (after arrivals)	minutes	20.0	International Air Transport Association
Passenger Accumulation	percent	60.0	Ricondo & Associates, Inc.
Retrieval Zone Depth	feet	12.0	International Air Transport Association
Area per Passenger in Retrieval Zone for LOS C	square feet	18.0	International Air Transport Association

SOURCES: International Air Transport Association, *Airport Development Reference Manual*, 10th ed., March 2014; Ricondo & Associates, Inc., July 2015.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.2.3 FACILITY REQUIREMENTS

This section discusses the analyses that have been conducted to define functional terminal facility requirements through 2035. Requirements have been developed for the following terminal facilities:

- Check-in Facilities
- Passenger Security Screening Checkpoint
- Holdrooms
- Outbound Baggage Makeup Facilities
- Domestic Baggage Claim

The following is a summary of the gaps between the facility requirements and the current facility capabilities:

- The current check-in facility inventory will be able to accommodate passenger demand levels beyond the planning horizon.
- Additional checkpoint lanes will be required between 2020 and 2025 to accommodate both the increasing demand levels and the ability to accommodate Pre✔ passengers.
- The current holdroom areas are deficient at today's passenger levels.
- Outbound baggage makeup will need to be expanded between 2020 and 2025.
- The current baggage claim retrieval area is deficient in the current terminal.

4.2.3.1 Check-in

Passenger demand for check-in facilities was modeled using spreadsheets to determine the number and types of check-in units that would be needed to maintain the Airport's prescribed LOS standard for check-in wait times. **Table 4.2-11** lists the number of required check-in positions that correlate to the respective DDFS activity levels. The terminal inventory of check-in positions should provide adequate capacity to support the DDFS activity levels; however, additional kiosks would be needed. A contemporary check-in lobby includes a mix of remote self-service devices, bag-drop positions, and full-service agent positions, as represented on **Exhibit 4.2-5**.

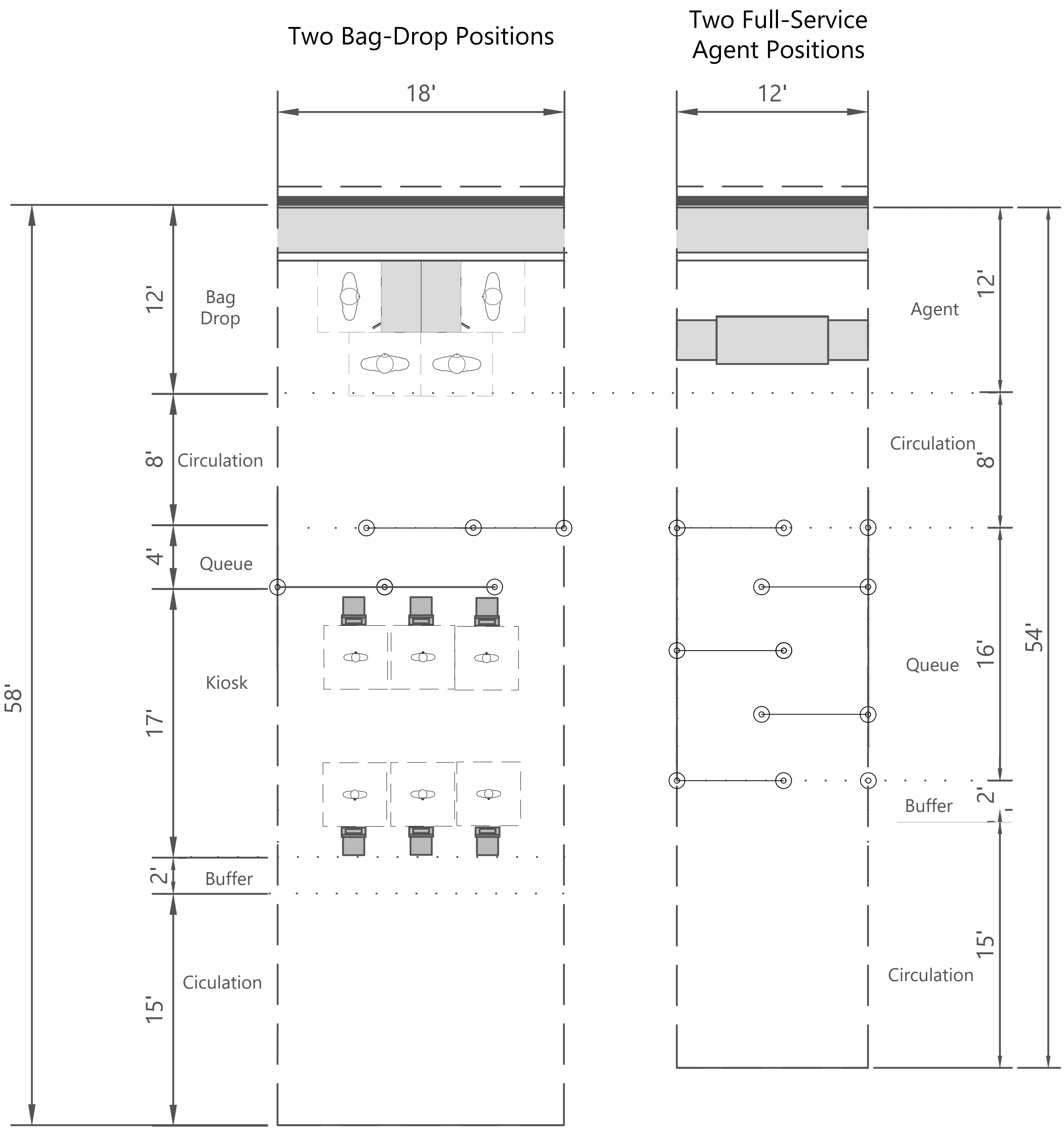
Table 4.2-11: Check-In Requirements

PASSENGER PROCESSING	UNITS	EXISTING	2015	2020	2025	2035
Peak Hour Originating Passengers [1/]	passengers	N/A	382	382	404	459
Peak Hour Check-in Demand	passengers	N/A	294	294	311	353
Kiosks	positions	N/A	11	11	12	14
Agent Positions	positions	24	10	11	12	13

NOTE:

1/ At scheduled time of departure.

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.



SOURCE: International Air Transport Association, *Airport Development Reference Manual*, 10th ed., March 2014 (Planning Guidelines).
PREPARED BY: Ricondo & Associates, Inc., November 2015.

EXHIBIT 4.2-5

NORTH 0 □0 ft□

Check-in Template

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Terminal\CAD\EYW_LobbyDepth_CheckinIATA_short.dwgLayout: EYW-325 SF Dom Queue Plotted: Jun 11, 2020, 11:02PM

4.2.3.2 Passenger Security Screening Checkpoint

Spreadsheet modeling was used to determine the number of security screening lanes needed to maintain the LOS standard for security wait times and to estimate the number of passengers waiting in queue. **Table 4.2-12** lists the peak hour demand basis and the requirements for the security screening lanes that correlate to the respective DDFS activity levels. For 2015 and 2020 DDFS, the terminal inventory of security screening lanes should provide adequate capacity to support the demand levels without providing a separate lane for Pre✓. DDFS 2025 and 2035 require an additional lane as either a Pre✓ lane or a standard lane. TSA has protocol to allow Pre✓ passengers to use a standard lane, which should be planned. **Exhibit 4.2-7** illustrates the space template, including a unit for advanced imaging technology (AIT). The template module does not include TSA corollary areas for AIT workstations, administrative space, technical support space, or common exit circulation corridors beyond the recomposure area. The TSA checkpoint corollary area requirements are based on the *Checkpoint Design Guide*[9], which recommends 150 square feet per screening lane.

Table 4.2-12: Security Screening Checkpoint Requirements

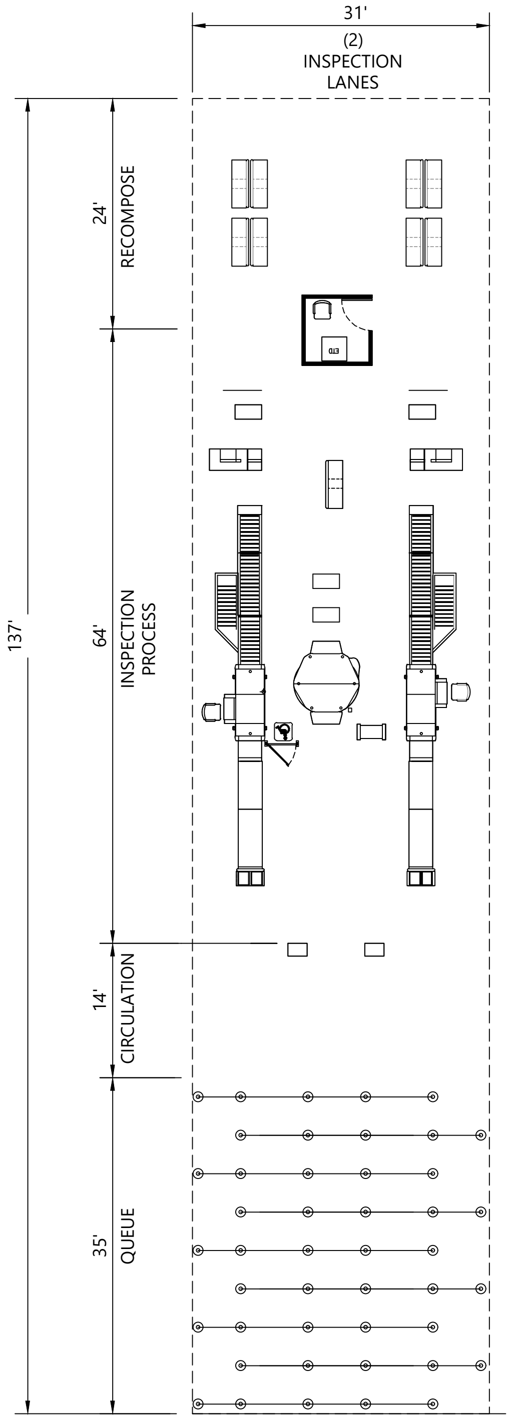
PASSENGER PROCESSING	UNITS	EXISTING	2015	2020	2025	2035
Peak Hour Originating Passengers [1/]	passengers		382	382	404	459
Peak Hour Checkpoint Demand	passengers		305	305	323	367
Pre✓	lanes	0	0	0	1	1
Standard	lanes	2	2	2	2	2
Total Lanes	lanes	2	2	2	3	3

NOTE:

1/ At schedule time of departure.

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

9 Transportation Security Administration, *Checkpoint Design Guide (CDG), Revision 5.1*, May 2014.



SOURCE: Transportation Security Administration, *Checkpoint Design Guide (CDG), Revision 5.1*, May 2014.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

EXHIBIT 4.2-6

NORTH 0 0 ft

Security Screening Checkpoint Template

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Terminal\CAD\EYW_TSA_SSCP.dwgLayout: EYW-SSCP Plotted: Jun 11, 2020, 11:10PM

4.2.3.3 Holdrooms

The holdroom planning criteria described in Section 4.2.2.3 was applied to every flight reflecting the peak hour for passenger demand in order to determine the aggregate holdroom area requirement. Peak 20-minute flight operations were utilized to determine the number of aircraft gate positions needed. **Table 4.2-13** lists holdroom requirements. The existing facility has sufficient total area but is lacking in seated areas to meet current demand levels. As peak hour enplaned passengers increase in the future planning horizons, this shortfall will increase to approximately 1,000 square feet of seating area. Additional queueing area will be required by 2025 as well. The space template for a narrow-body holdroom based on IATA planning guidelines is shown on **Exhibit 4.2-8**.

Table 4.2-13: Holdroom Requirements

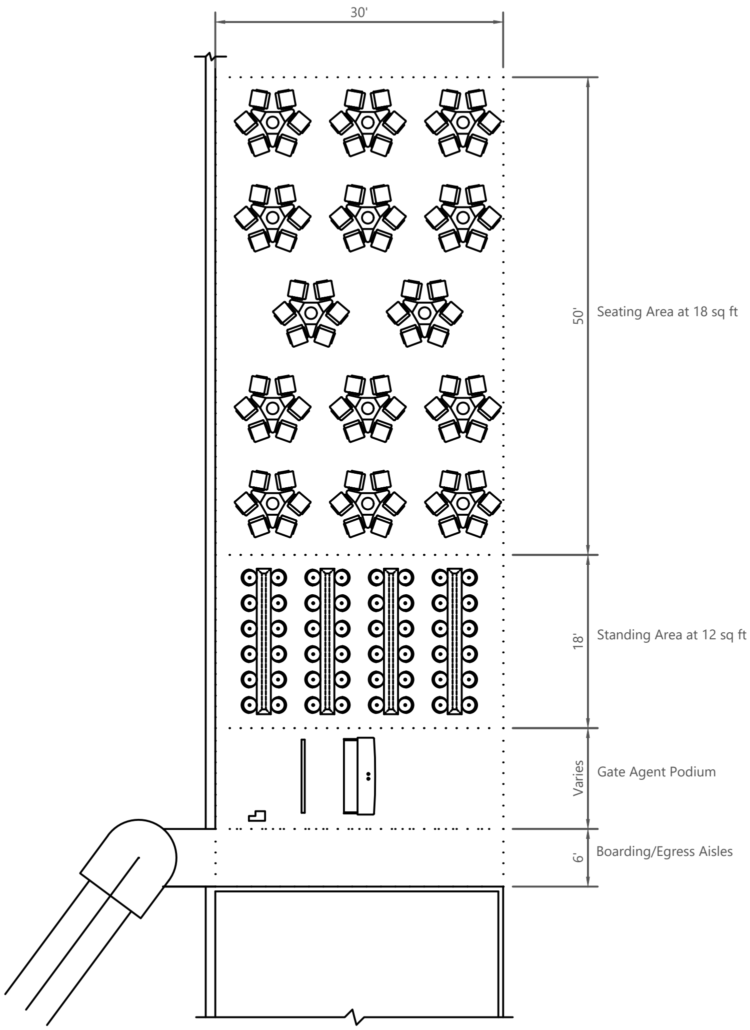
HOLDROOMS	UNITS	PLANNING FACTOR	EXISTING	2015	2020	2025	2035
Peak 20-minute Departures	flights			3	3	3	3
Agent Counter Area 1/	square feet	120	780	360	360	360	360
Agent Counter Positions	positions	2	12	6	6	6	6
Aisleway 2/	square feet	180	920	540	540	540	540
Peak Hour Enplaned Passengers	**Passengers**			**292**	**301**	**324**	**361**
Seated	square feet	18	2,820	3,154	3,251	3,499	3,899
Standing	square feet	12	1,120	701	722	778	866
Queuing	square feet	11	670	642	662	713	794
Total Area			**6,310**	**5,397**	**5,535**	**5,890**	**6,459**

NOTES:

1/ Based on 4 feet wide by 30 feet deep.

2/ Based on 6 feet wide and 30 feet deep.

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.



Seating Configuration

Criteria	Planning Guidelines
Boarding/Egress Aisle (sq ft)	180
Gate Agent Podium (sq ft)	120
Seating Area (sq ft)	1,490
Standing Area (sq ft)	540
Queue Area (sq ft)	0
Number of Seats (ea)	128

NOTES:
1/ Holdroom reflects sizing to accommodate passengers on a single 150 seat narrowbody aircraft.

SOURCE: International Air Transport Association, *Airport Development Reference Manual,* 10th ed., March 2014 (Planning Guidelines).
PREPARED BY: Ricondo & Associates, Inc., September 2016.

EXHIBIT 4.2-7

NORTH 0 0 ft

Holdroom Template

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Terminal\CAD\EYW_Holdroom_Configuration.dwgLayout: FYW-holdroom Plotted: Jun 11, 2020, 10:59PM

4.2.3.4 Outbound Baggage Makeup

A spreadsheet model was used to determine the number of carts required to support the peak 10-minute flight makeup period. **Table 4.2-14** lists outbound baggage makeup requirements that correlate to the respective DDFS activity levels. The current baggage makeup area should provide adequate capacity to 2020; additional area will be needed after 2020. To provide redundancy while the primary device is undergoing maintenance, a second outbound bag makeup device is also recommended in the intermediate/long-term. The space template shown on **Exhibit 4.2-8** is based on the device currently functioning at the Airport.

Table 4.2-14: Baggage Makeup Requirements

OUTBOUND BAGGAGE MAKEUP	UNITS	EXISTING	2015	2020	2025	2035
Peak 10-minute Flights in Makeup	operations	N/A	6	7	7	8
Cart Requirement	cart	16	12	14	18	20

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

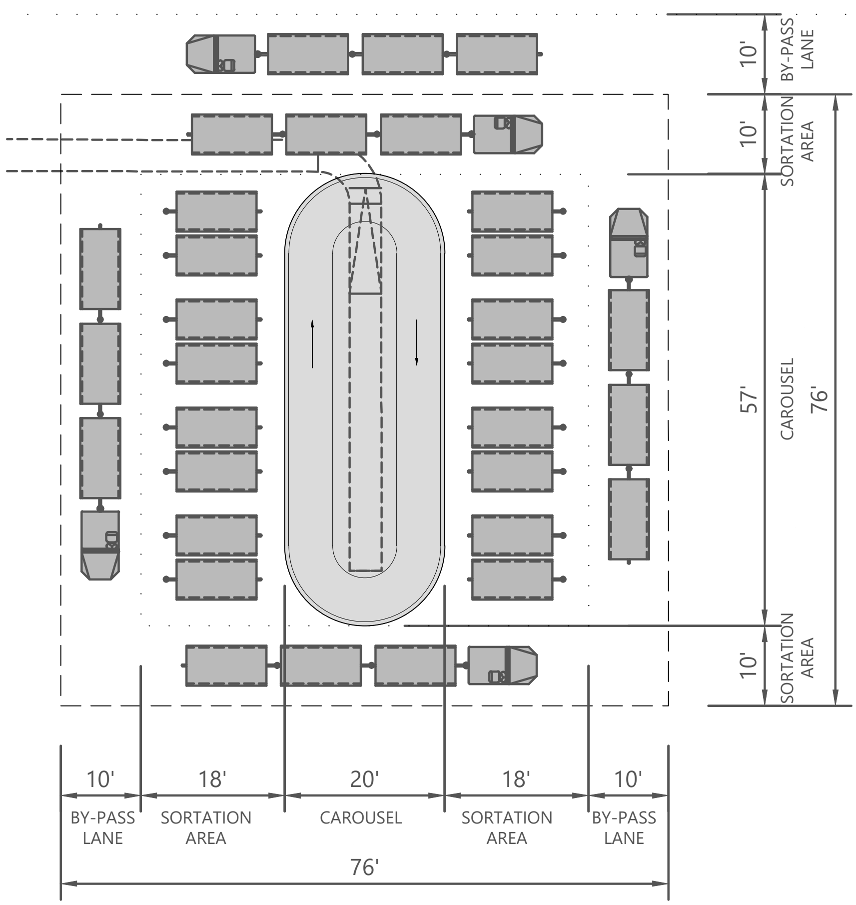
4.2.3.5 Bag Claim

A spreadsheet model was used to determine domestic baggage claim requirements based on last bag delivery occurring within 20 minutes of flight arrival. **Table 4.2-15** lists the baggage claim requirements that correlate to the respective DDFS activity levels. An additional baggage claim area will be needed. The space requirement for baggage claim is based on the devices currently functioning at the Airport, as shown on **Exhibit 4.2-9**, and the desired level of service for area per passenger.

Table 4.2-15: Baggage Claim Requirements

DOMESTIC BAGGAGE CLAIM	UNITS	EXISTING	2015	2020	2025	2035
Peak 20-minute Passengers with Bags	passengers	N/A	164	170	174	201
Peak 20-minute Operations	operations	N/A	2	2	2	2
Baggage Claim Requirement	device	2	2	2	2	2
Retrieval Area Requirement	sq ft	N/A	2,952	3,060	3,132	3,618
Total Baggage Claim Area Requirement	sq ft	3,096	4,541	4,707	4,818	5,566

SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.



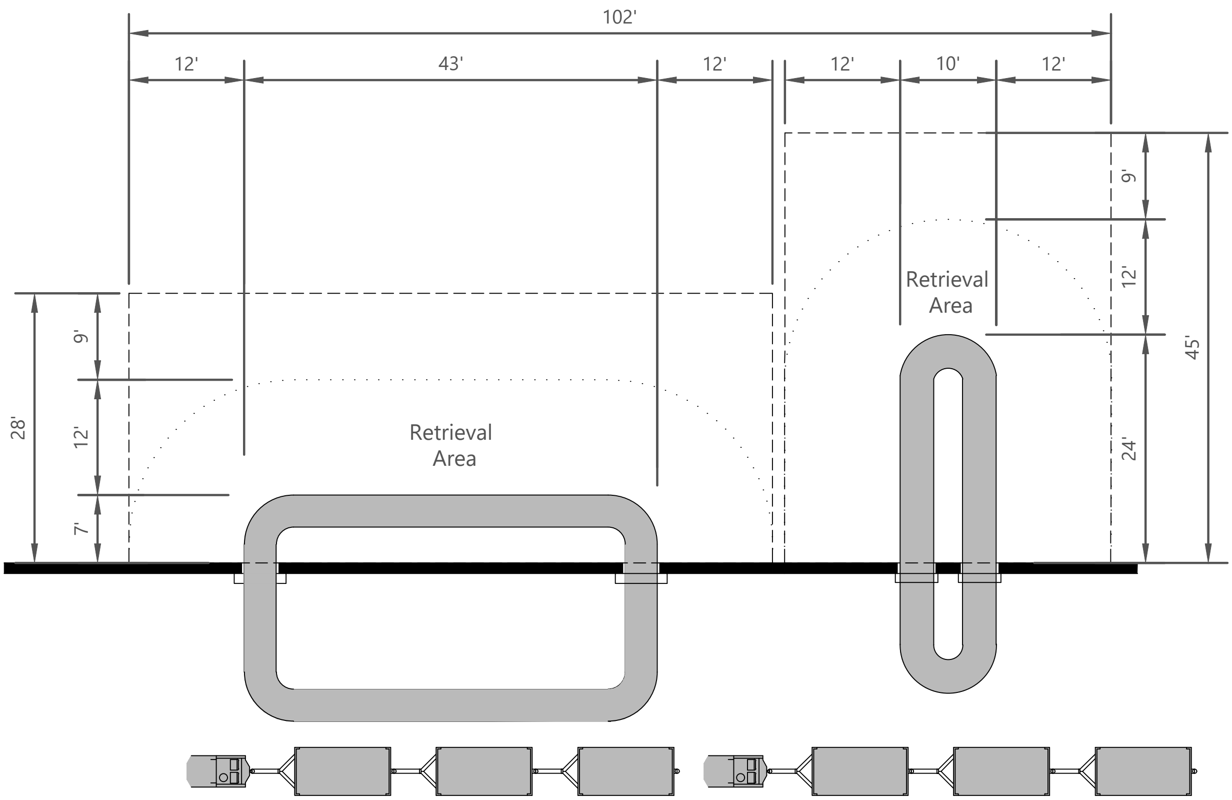
SOURCE: Ricondo & Associates, Inc., September 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

EXHIBIT 4.2-8

NORTH 0 30 ft

Baggage Make-up Template

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Terminal\CAD\EYW-OutboundBaggage.dwgLayout: EYW-PERPENDICULAR Plotted: Jun 11, 2020, 11:19PM



AREA PER DEVICE:
1,500-1,800 sq ft

SOURCE: Airport Cooperative Research Program, Report 25, *Air Passenger Terminal Planning and Design*, Vol. 1, *Guidebook*, 2010 (Critical Dimensions).
PREPARED BY: Ricondo & Associates, Inc., September 2016.

EXHIBIT 4.2-9

NORTH 0 □0 ft□

Baggage Claim Template

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Terminal\CAD\EYW-BagClaim.dwgLayout: EYW-Flat Plotted: Jun 11, 2020, 11:21PM

4.3 On-Airport Curbsides and Roadways

This section documents the ground access facility requirements developed as part of the Master Plan Update. Requirements were developed for the following ground access elements:

- Terminal curbsides
- On-Airport roadway links

Spreadsheet-based mathematical models were used to identify existing facility demands and future requirements for the peak-month-average-day terminal departure peak hour and the peak-month-average-day terminal arrival peak hour. Utilizing annual passenger forecasts, facility demand and requirements were developed for existing (2015) and future-year (2020, 2025, and 2035) conditions.

4.3.1 EXISTING CONDITIONS

To determine the baseline demand, data were collected by CH Perez & Associates Consulting Engineers, Inc. on August 13, 2016. The data collected included roadway traffic volumes determined in the form of intersection counts, curbside vehicle classification, and curbside dwell times. Due to the remoteness of the airport with respect to connectivity to other airport hubs, there was only one significant daily peak period at the Airport. Therefore, data were collected from 10:00 a.m. to 2:00 p.m. to determine the vehicular activity at the Airport. Since August 2016 data represent a volume lower than the 2015 design day, the August 2016 data were factored up to 2015 design day values for the remainder of the analysis. Future demand levels for terminal curbsides, Airport roadways, and the parking demand were assumed to increase from 2015 levels at rates proportional to the passenger forecasts.

4.3.1.1 Determining Peak Hours

The primary Airport roadway system and curbside facilities are planned to accommodate activity during peak hour conditions. Peak passenger activity was determined using the flight schedules, seats per plane, and typical EYW load factors.

Peak Hour

From the schedule data it was observed that there was only one daily peak period that occurred from 10:00 a.m. to 2:00 p.m. on Saturday. The peak hour occurred from 10:00 a.m. to 11:00 a.m. with 194 vehicles entering and 224 vehicles exiting the Airport area. This peak was primarily driven by the activity of the Delta Airlines who operates flights with Boeing 737 aircraft, which affects the overall number of passengers at the Airport.

4.3.1.2 Terminal Curbside

There are two curbsides at the Airport: a departing curbside and an arrival curbside. The departing curbside is 375 feet in length and is used by private vehicles, taxicabs, limos, and shuttles. The arrivals curbside is divided into three distinct areas: 184 feet for curbside taxicab and public transit bus loading, 66 feet for private vehicle loading, and 177 feet for commercial vehicle loading, as shown on **Exhibit 4.3-1**. In addition to these arrival curbside areas, there is 100 feet for taxicab staging upstream of the curbside area, but this is not included in the useable curbside area calculation as it is just taxicab storage. Curbside utilization is determined by length of the allocated curbside, the average dwell time of the curbside vehicle, and the number of vehicles using the curb. Results of the terminal curbside facility requirement analyses are discussed in Section 4.3.3.1.

4.3.1.3 Airport Roadways

All Airport traffic enters from eastbound or westbound South Roosevelt Boulevard. After entering the Airport limits, vehicles follow signage leading to the arrival or departure curbsides, parking lots, or rental car return area. **Exhibit 4.3-2** identifies the discrete roadway links traveled by vehicles to these destinations, which were modeled to determine their utilization. The airport roadway facility requirement link analyses are discussed in Section 4.3.3.2.

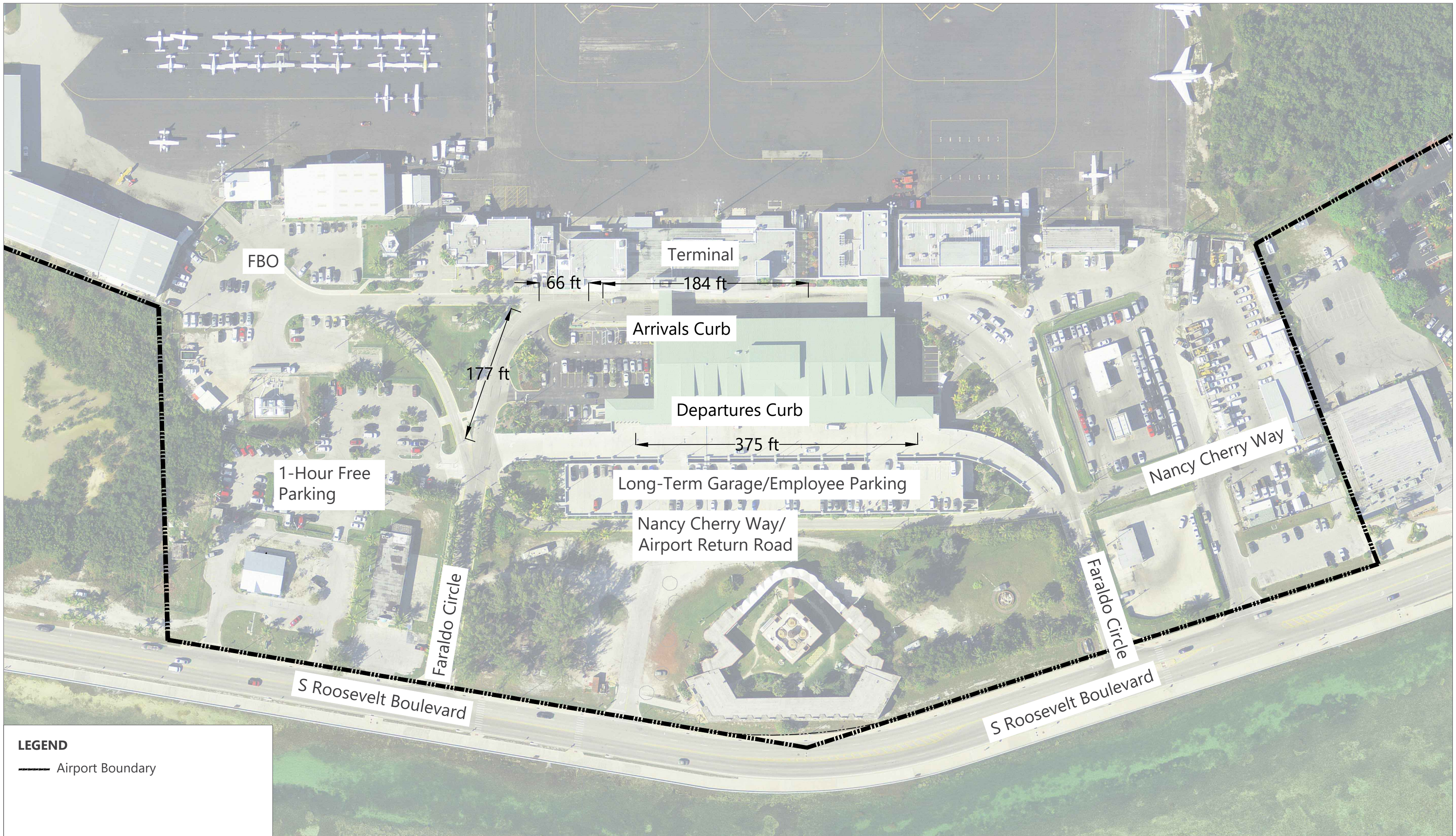
4.3.2 GROUND ACCESS ACTIVITY FORECAST

Airport-related traffic volumes for future years 2020, 2025, and 2035 were derived by increasing the 2015 Airport-related traffic volumes proportionally to the passenger forecast, which is summarized in **Table 4.3-1**. Privately operated vehicles and low-occupancy commercial vehicles (e.g., taxicabs, limousines, shared ride vehicles) were assumed to increase at a rate proportional to the passenger volumes (presented in Table 4.3-1). Higher-occupancy commercial vehicles (e.g., shuttles, buses), which are able to accommodate more passengers using larger vehicles, were assumed to increase at approximately half the rate applied to privately operated vehicles.

Table 4.3-1: Future Year Passenger Forecasts

	ANNUAL ENPLANED		PEAK HOUR ENPLANED	
YEAR	PASSENGERS	PERCENT GROWTH FROM YEAR 2015	PASSENGERS	PERCENT GROWTH FROM YEAR 2015
2015	362,802	--	355	--
2020	430,764	18.7%	398	12.1%
2025	482,844	33.1%	426	20.2%
2035	577,053	59.1%	485	36.8%

SOURCE: Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.



SOURCE: Jacobs, September 2015 (Basemap and Aerial Photography).
PREPARED BY: Ricondo & Associates, Inc., October 2016.

EXHIBIT 4.3-1

NORTH 0 □00 ft

Curb Dimensions

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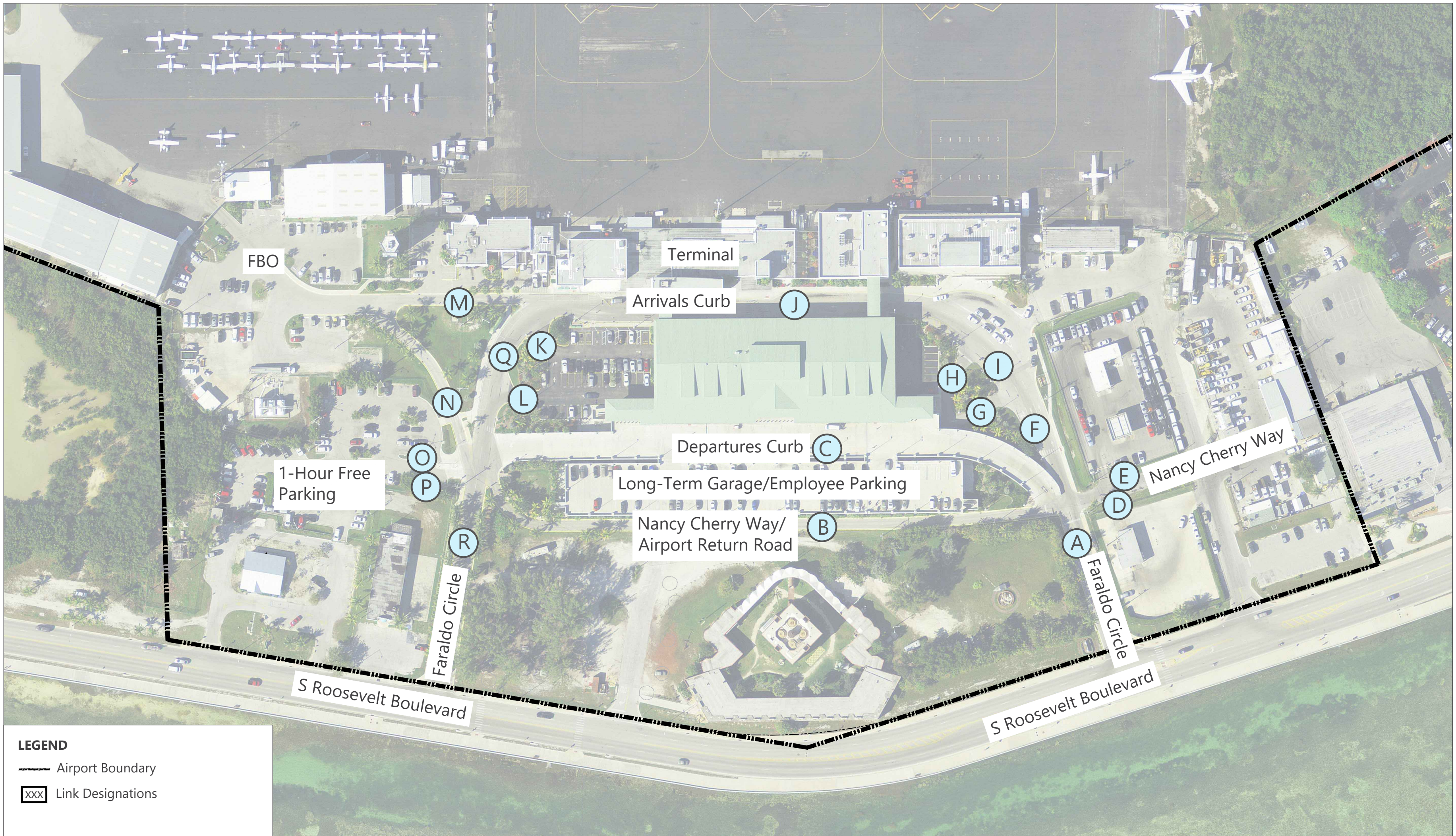

SOURCE: Jacobs, September 2015 (Basemap and Aerial Photography).
PREPARED BY: Ricondo & Associates, Inc., November 2016.

EXHIBIT 4.3-2

NORTH 0 □00 ft

Roadway Links Designation

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4.3.3 GROUND ACCESS FACILITY REQUIREMENTS

4.3.3.1 Terminal Curbside

The peak hour traffic volumes from the classification data collection were used to represent the number and types of vehicles using the terminal curbsides. The traffic volumes were also utilized to estimate the linear requirements for terminal curbsides during the peak hour for curbside traffic.

Approach

A curbside demand and requirements model was developed to analyze the number of vehicles requiring curbside frontage during a busy period of the peak hour. The model incorporated data for the number and types of vehicles and average dwell times at curbside during the peak hour. To account for non-uniform arrival rates during the peak hour, a statistical surge factor, based on a Poisson distribution, was used in the model to determine the number of occupied curbside parking spaces during the peak hour.[10] Demand for curbside frontage was converted from space to linear feet by multiplying the number of occupied parking spaces during the peak hour against an average vehicle length. The average vehicle length includes empty space between two parked vehicles and lost spaces from parking inefficiencies. Overall, curbside frontage demand represents the peak accumulation of vehicles waiting at the curbside, aligned nose-to-tail in a single queue.

The existing curbside utilization factor was calculated by dividing the linear feet of curbside frontage demand by existing curbside length. The curbside utilization factor was correlated to a LOS framework to indicate the level of congestion at curbside. For example, a very low utilization factor indicates that vehicles are easily accommodated along the inner lane without the need to double-park. This utilization factor equates to an excellent LOS, or LOS A. Conversely, a very high utilization factor equates to double and triple parking along the entire curbside, restricting vehicle movements and resulting in a poor LOS (i.e., LOS F). **Table 4.3-2** correlates curbside LOS to the utilization ranges for passenger loading/unloading. LOS C is generally a desirable condition during peak activity periods at major airports for most days of the year. LOS D conditions may be acceptable during peak seasonal periods. LOS D or better along the curbsides is considered acceptable, while LOS E and F are considered unacceptable.

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10 In probability theory and statistics, the Poisson distribution is a discrete probability distribution that expresses the probability of a given number of events occurring in a fixed interval of time and/or space if these events occur with a known average rate and independently of the time since the last event.

Table 4.3-2: Curbside Level of Service and Utilization Ranges

LEVEL OF SERVICE	SINGLE-LANE LOADING UTILIZATION (ARRIVALS)	MULTIPLE-LANE LOADING UTILIZATION (DEPARTURES)	DESCRIPTION
A	0% – 70%	0% – 90%	Excellent: Drivers experience no interference from pedestrians or other motorists.
B	71% – 85%	91% – 110%	Very Good: Relatively free-flow conditions with limited double parking.
C	86% – 100%	111% – 130%	Good: Double parking near terminal entrance doors is common with some intermittent triple parking.
D	101% – 115%	131% – 170%	Fair: Vehicle maneuverability restricted due to frequent double/triple parking.
E	116% – 130%	171% – 200%	Poor: Significant delays and queues; double/triple parking throughout curbside.
F	> 131%	> 201%	Failure: Motorists unable to access/depart curbside; significant queuing along entry road.

SOURCE: Ricondo & Associates, Inc., September 2016 (based on information published in Airport Cooperative Research Program, Report 40, *Airport Curbside and Terminal Area Roadway Operations*, July 2010).
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Curbsides serving commercial vehicles and private vehicle loading of arrivals passengers were analyzed assuming passenger loading/unloading only occur in the lane directly adjacent to the curbside (i.e., single-lane loading).

It was assumed that all vehicles unloading on the departures level could occur in the lane directly adjacent to the curbside and with an allowance for additional vehicle unloading in the second lane (i.e., multiple-lane loading). Curbsides with multiple-lane loading are not considered to be operating at a poor LOS when all available curbside length is used (100 percent utilization). In other words, even when a single lane is fully utilized, parked vehicles are still able to access and depart the curbside, because they are not blocked by vehicles in the second parking lane. Conversely, double or triple parking or queuing along 100 percent of both the loading lane and the adjacent travel lane constitutes a failed LOS (i.e., greater than 200 percent utilization, LOS F).

Results

Airport-related traffic volumes for future years 2020, 2025, and 2035 were derived by increasing the 2015 Airport-related traffic volumes proportionally to the peak hour passenger forecast. The results of the future year (2020, 2025, and 2035) terminal curbside analysis are presented in **Table 4.3-3**. For comparison purposes, curbside requirements correlating to LOS C and LOS D were calculated. Both the departure level and arrivals level commercial vehicles curbside areas operate with a surplus capacity for LOS C conditions through design year 2035. The arrivals level private vehicle curbside is too short for either LOS C or LOS D conditions in all design year conditions

Table 4.3-3: Curbside Requirements Summary

	PEAK HOUR			
	2015	**2020**	**2025**	**2035**
Departure Level				
Demand	300	325	325	375
Capacity	375	375	375	375
Required Curbside Length				
LOS C	231	250	250	288
LOS D	176	191	191	221
Surplus/(Deficit)				
LOS C	144	125	125	87
LOS D	199	184	184	154
Arrival Level Private Vehicles				
Demand	125	125	125	150
Capacity	66	66	66	66
Required Curbside Length				
LOS C	125	125	125	150
LOS D	109	109	109	130
Surplus/(Deficit)				
LOS C	(59)	(59)	(59)	(84)
LOS D	(43)	(43)	(43)	(64)
Arrival Level Commercial Vehicles				
Demand	230	295	295	325
Capacity	361	361	361	361
Required Curbside Length				
LOS C	230	295	295	325
LOS D	200	257	257	283
Surplus/(Deficit)				
LOS C	131	66	66	36
LOS D	161	104	104	78

NOTES:

LOS – Level of Service

LOS C – Good Level of Service

LOS D – Fair Level of Service

SOURCE: Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.3.3.2 Airport Roadways

A spreadsheet model was used to analyze the Airport roadway system and the components that are used by various Airport ground transportation modes to access key Airport destinations, such as the Airport entry/exit, curbsides, parking facilities, and rental car facilities. The Airport roadway system and associated components included in the analysis are depicted on Exhibit 4.3-2.

Approach

Peak hour traffic volumes, which were discussed in Section 4.3.1.1, were compared to the individual roadway segment capacities to determine the Airport roadway system requirements. The capacity of a roadway segment is determined by its characteristics, including free-flow speed and the number of travel lanes. **Table 4.3-4** correlates the maximum free-flow speeds for typical Airport roadway components to the maximum sustainable flow rates under different LOS standards. The maximum flow rates were used to assess the number of lanes that are needed to accommodate anticipated traffic volumes along a roadway segment. Similar to the terminal curbside LOS framework, LOS refers to the operating performance of a roadway, measured quantitatively and reported on a scale of A to F. LOS A represents the optimal operating condition, characterized by uninterrupted free-flow operations. Conversely, LOS F represents the worst operating condition, characterized by severe roadway congestion and delay. LOS C is generally considered to be a desirable operating condition for the design of new facilities; however, LOS D conditions may be acceptable at some seasonal destination airports during peak periods of the typical busy day of the peak season (such as the design day analyzed for this study). For this analysis, future peak hour conditions experiencing LOS D or better were considered acceptable; and new roadway capacity should be constructed prior to roadways reaching LOS E (unacceptable).

Table 4.3-4: Roadway Levels of Service and Maximum Flow Rates

		MAXIMUM FLOW RATES (VEHICLES/HOUR/LANE) AT INDICATED LEVELS OF SERVICE 1/				
TYPICAL ROADWAY CLASSIFICATIONS 2/	**MAXIMUM FREE-FLOW SPEED (MPH) 2/**	**A**	**B**	**C**	**D**	**E**
Entry/Exit Roadway	50	440	730	1,050	1,380	1,620
	45	400	650	940	1,250	1,530
Terminal Loop Roadway	40	360	600	860	1,130	1,410
	35	330	540	790	1,030	1,290
Terminal Access Roadway	30	310	480	700	930	1,170
	25	250	400	600	800	1,010
Ramps (25 MPH or less)	15	250	400	600	800	1,010

NOTES:

MPH = Miles per Hour

Level of Service: A – Excellent, B – Very Good, C – Good, D – Fair, E – Poor, F – Failure

1/ Flow rates were adjusted to account for heavy vehicles and the effects of unfamiliar drivers.

2/ The roadway classifications and associated speeds represent typical ranges that vary by airport.

SOURCE: Ricondo & Associates, Inc., September 2016 (based on information presented in [a] National Research Council, Transportation Research Board, *Highway Capacity Manual*, Exhibit 21-2, "LOS Criteria for Multilane Highways," December 2000; and [b] Airport Cooperative Research Program, Report 40, *Airport Curbside and Terminal Area Roadway Operations*, Table 4-1, "Levels of Service for Airport Terminal Area Access and Circulation Roadways," July 2010).

PREPARED BY: Ricondo & Associates, Inc., September 2016.

Results

On-Airport traffic volumes for future years 2020, 2025, and 2035 were derived by increasing the August 2016 data on peak hour traffic and then increasing the data proportionally to the peak hour passenger forecast that is summarized in Table 4.3-1. The results of the on-Airport traffic volumes are presented in **Table 4.3-5**, with the corresponding links found in Exhibit 4.3-2. All roadway links at the Airport operate at LOS B or better through the planning horizon.

Table 4.3-5: On-Airport Roadway Demand/Capacity Results

			2015		2020		2025		2035	
DESIGNATION	LOCATION	NUMBER OF LANES	VOLUME	LOS	VOLUME	LOS	VOLUME	LOS	VOLUME	LOS
A	Entrance to Airport Faraldo Circle	2	323	A	362	A	388	A	442	A
B	Nancy Cherry Way/Airport Return Road	1	120	A	135	A	144	A	164	A
C	Departure Roadway	1	115	A	129	A	138	A	157	A
D	EB Nancy Cherry Way	1	60	A	67	A	72	A	82	A
E	WB Nancy Cherry Way	1	19	A	22	A	23	A	27	A
F	Faraldo Circle after Turn off to Departure Roadway Before Garage Entrance	1	288	B	323	B	346	B	393	B
G	Long-Term Garage Entrance	1	4	A	4	A	4	A	5	A
H	Long-Term Garage Exit	1	9	A	10	A	11	A	12	A
I	Faraldo Circle between Garage Entrance and Exit	2	284	A	319	A	341	A	389	A
J	Arrivals Roadway	1	282	B	317	B	339	B	386	B
K	Rental Car Entrance	1	85	A	95	A	102	A	116	A
L	Rental Car Exit	1	201	A	226	A	242	A	275	B
M	FBO Entrance	1	12	A	14	A	15	A	17	A
N	FBO Exit	1	30	A	34	A	36	A	41	A
O	1-Hour Surface Lot Entrance	1	67	A	75	A	81	A	92	A
P	1-Hour Surface Lot Exit	1	12	A	14	A	15	A	17	A
Q	Faraldo Circle between RAC Entrance and Exit	1	185	A	208	A	223	A	253	B
R	Exit Airport Faraldo Circle	2	357	A	400	A	428	A	488	A

NOTES:

LOS – Level of Service

LOS A – Excellent

LOS B – Very Good

EB – East Bound, WB – West Bound

FBO – Fixed-base Operator

SOURCES: CH Perez & Associates Consulting Engineers, Inc., August 2016; Ricondo & Associates, Inc., August, 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.4 Pubic Parking

This section documents the public parking facility requirements developed as part of the Master Plan Update.

4.4.1 EXISTING CONDITIONS

To determine the baseline demand, parking data were collected based on on-site parking capacity observations and Airport staff observations on August 13, 2016. Future levels for parking demand were assumed to increase from 2015 levels at rates proportional to the passenger forecast.

There are three parking options operated on-site at the Airport. Additional overflow parking can be accommodated in the picnic area and parking near Fort East Martello Museum. The results of the staging lot analyses are discussed in this section.

4.4.2 METHODOLOGY AND ASSUMPTIONS

The Airport operates three parking facilities:

- Free 30-minute parking consists of three private vehicle spaces and five ADA accessible vehicle spaces directly across from the baggage claim curbside. Parking availability is on a first come, first served basis.
- There are 147 long-term spaces on the lower level of the garage under the departures curbside. These are paid parking spaces at an hourly rate up to $10/day. In the long-term garage area, 20 of these spaces are chained off for use, and occupied by airport maintenance equipment. The current 127 space capacity garage can reach 100 percent utilization during peak periods of the day during the peak period of the year.
- 1-hour free parking consists of 58 spaces located west of the terminal area. There is no controlled access to this lot, but the Airport staff approximates peak usage during the peak day is approximately 70 percent.

Existing public parking demand is typically determined using actual daily occupancy data from a parking access and revenue control system; however, due to the size of the Airport, the demand was determined by a site visit and feedback from airport staff. Since the long-term garage was completely full on the August data collection day, the estimated demand was the full garage capacity of 127 spaces, it is assumed the 1-hour surface lot was used to accommodate overflow demand of the long-term garage parking. The resulting requirements used for this study are depicted in **Table 4.4-1**. This peak daily occupancy was proportionally increased using the forecast to determine the future demands for the years 2020, 2025, and 2035.

Table 4.4-1: Public Parking Requirements

	CAPACITY	ESTIMATED OCCUPANCY RATE	ESTIMATED DEMAND	SERVICE FACTOR	REQUIREMENT
Long-Term Garage	147	86%	127	0%	127
1-Hour Surface Lot	58	69%	40	0%	40
Total	**205**		**167**		**167**

SOURCES: Key West International Airport, August 2016; Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.4.3 FORECAST PUBLIC PARKING REQUIREMENT

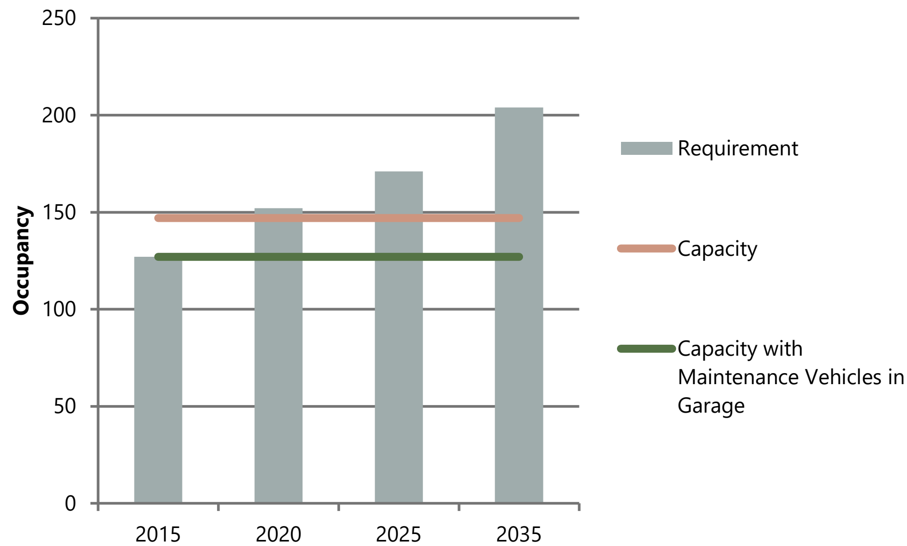
The public parking requirements consist of the minimum number of spaces needed to accommodate a parking demand. Typically, an additional buffer is applied, such that a patron is not searching for a last available space. However, due to the small size of the garage, no buffer was needed as all parking spaces can be checked for availability during one lap of the long-term garage. Thus, the demand for spaces can equal the requirement for spaces. The 2015 parking requirement was increased based on the total enplaned passengers (summarized in Table 4.3-1). The parking requirements are summarized in **Table 4.4-2**. **Exhibit 4.4-1** and **Exhibit 4.4-2** illustrate how the parking products compare to the capacity. Requirements were compared to available capacity in order to identify surpluses and deficiencies. The overall deficiency is expected to be 63 spaces by 2035, assuming the 20 maintenance spaces are converted back to public parking.

Table 4.4-2: Public Parking Requirements Compared to Existing Capacity

		2015	2020	2025	2035
Long-Term Garage	Requirement	127	152	171	204
	Surplus/(Deficit)	20	(5)	(24)	(57)
1-Hour Surface Lot	Requirement	40	48	54	64
	Surplus/(Deficit)	18	10	4	(6)
Total	**Requirement**	**167**	**200**	**225**	**268**
	Surplus/(Deficit)	**38**	**5**	**(20)**	**(63)**

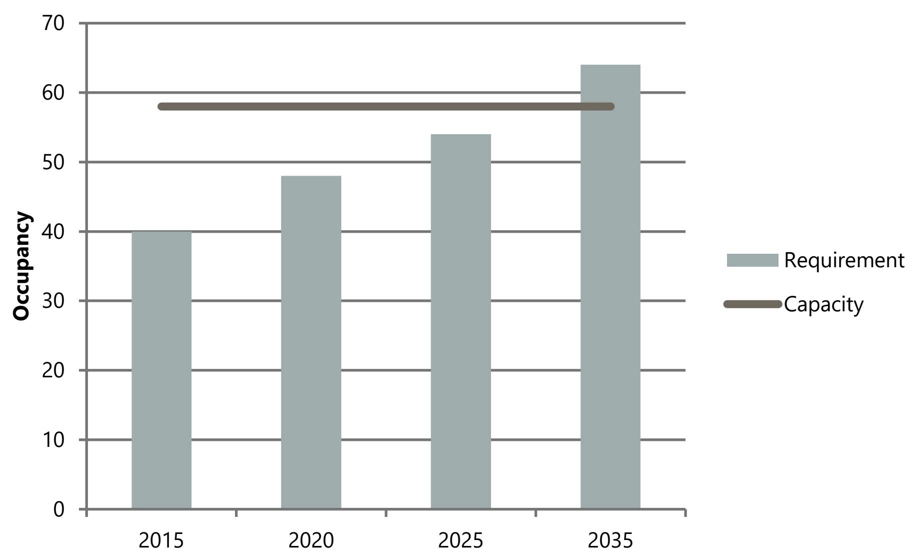
SOURCES: Key West International Airport, August 2016; Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Exhibit 4.4-1: Long-Term Garage Requirements Compared to Existing Capacity



SOURCES: Key West International Airport, August 2016; Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

Exhibit 4.4-2: 1-Hour Surface Lot Requirements Compared to Existing Capacity



SOURCES: Key West International Airport, August 2016; Ricondo & Associates, Inc., August 2016.
PREPARED BY: Ricondo & Associates, Inc., September 2016.

4.5 Rental Car Facilities

The rental car facilities at the Airport include counter areas in the arrivals terminal, a pick-up/return area on the ground floor of the parking garage, and rental car maintenance areas located at multiple locations.

To accommodate ready/return, rental car storage, and maintenance functions in a single location at the Airport, the Monroe County will pursue the development of consolidated rental car facility. The space program for this facility including customer service area, ready/return, and vehicle storage area requirements will be established as part of a standalone study.

4.6 Air Cargo

Air cargo facilities are economic drivers for airports of all types. When strategically developed and managed, their benefits can be exponential. High-value, time-sensitive commodities must be reliably and expeditiously moved throughout the aviation system.

Airports are an integral part of the transportation infrastructure; they accommodate international, national, regional, and local trade. Consequently, air cargo facilities must be responsive and flexible to the changes in these markets. They must also be optimally located, when feasible, and accessible both on and off the airport.

This Master Plan has examined EYW's existing and forecast air cargo demand and the capacity for its existing facilities, as well as identified facility requirements utilizing industry standards. The following sections provide a description of air cargo operations at EYW.

4.6.1 DESCRIPTION OF AIR CARGO OPERATIONS

The R&A Planning Team conducted interviews with the air cargo Operations Managers for FedEx and UPS at EYW in the spring and fall seasons of 2016. The purpose of these interviews was to gain insight into the potential changes in cargo activity or operations at EYW, to obtain detailed cargo operations and volumes for 2005 to 2015 for both all-cargo and belly cargo, and to identify the level of growth the cargo airlines anticipate in relation to travel to Cuba. The cargo operators were also encouraged to offer any additional input regarding their operations. **Exhibit 4.5-1** shows the locations of the FedEx and UPS air cargo facilities at EYW.

Currently, there are two air cargo operators at EYW: FedEx and UPS. To supplement their delivery systems, FedEx subcontracts Mountain Air Cargo (Mountain Air) to fly its cargo, and UPS subcontracts Martinaire Aviation (Martinaire) to fly its cargo. UPS and FedEx are both certificated airlines and are described as integrated freight carriers, because they transport freight from door-to-door using their own fleet of trucks and aircraft.

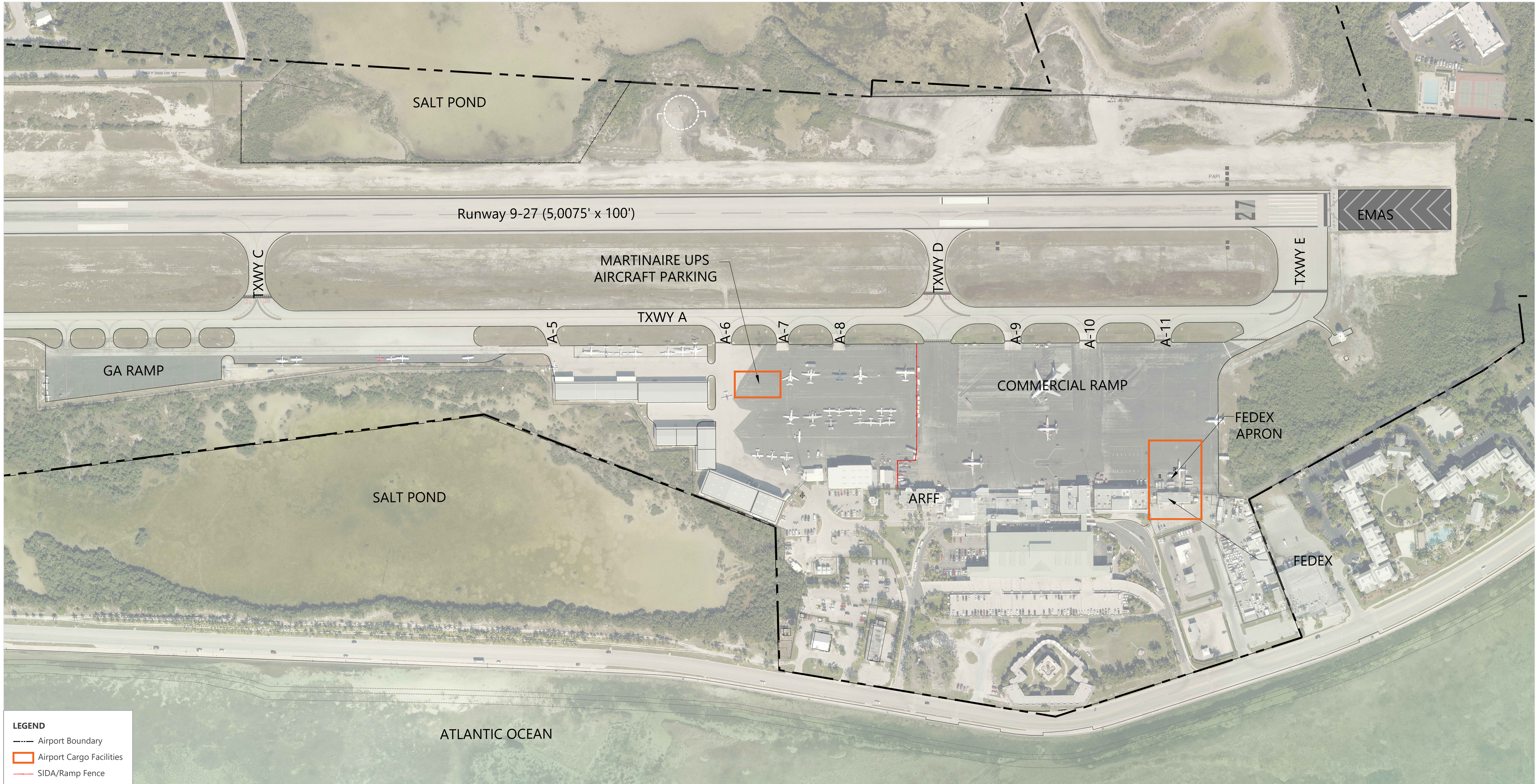


EXHIBIT 4.5-1

Airport Cargo Facilities

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\GA\Exhibit 4.5-1 Airport Cargo Facilities.dwgLayout: 11x17L Plotted: Jun 11, 2020, 05:26PM

In addition, EYW has commercial service airlines that transport cargo along with passenger luggage in the bellies of aircraft. As indicated in the aviation forecasts presented in Section 2 of this Master Plan, this type of cargo constituted less than 0.3 percent of total cargo volumes at EYW in 2015.[11]

4.6.1.1 Martinaire Aviation

Martinaire is a subcontractor of UPS. Martinaire's staff at EYW consists only of pilots, and the Cessna Caravan CE 208B comprises its fleet, which is shown on **Exhibit 4.5-2**. The Cessna Caravan CE 208B is a single-engine, turboprop aircraft configured for air cargo; it has a useful load of 3,000 pounds, which includes the pilot, cargo, and fuel. Only one of these aircraft is parked on the apron during the day.

Martinaire flies roundtrip to Miami International Airport (MIA) for UPS. Outbound cargo is flown between 7:30 p.m. and 8:00 p.m., Monday through Friday. Inbound cargo from MIA arrives between 8:00 a.m. and 8:30 a.m. Tuesday through Saturday. One to two UPS trucks enter EYW through Gate 5, which is shown on **Exhibit 4.5-3**, and UPS staff are responsible for loading and unloading the air cargo.

Exhibit 4.5-2: Martinaire Cessna 208 Cargo Aircraft

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Exhibit 4.5-3: UPS Air Cargo Trucks at Gate 5

PREPARED BY: American Infrastructure Development, Inc., 2016.

[11] U.S. Department of Transportation, T-100, July 2016.

4.6.1.2 FedEx

FedEx handles air cargo operations at EYW, as well as at Florida Keys Marathon International Airport (MTH). MTH is a general aviation airport approximately 50 miles northeast. MTH and EYW have a shared function, since the FedEx trucks originating out of Fort Lauderdale-Hollywood International Airport (FLL) make stops at MTH to load and unload their cargo before proceeding to EYW. They also stop at MTH to load and unload cargo before continuing to FLL.

All employees based at the facility are FedEx employees and the pilots are Mountain Air employees. FedEx owns the aircraft, but aircraft are flown by Mountain Air pilots. The aircraft flown by Mountain Air are painted in the FedEx livery. Mountain Air pilots fly the aircraft roundtrip to FLL. All 14 employees housed at the facility are FedEx employees. Mountain Air flies the Cessna 208 Caravan, as shown on **Exhibit 4.5-4**, which has a maximum capacity of 2,400 pounds. The peak period for operations runs approximately 3 to 4 weeks prior to Christmas day, at which time all the aircraft are at capacity. Some typical items include clothing, food, medical supplies and equipment, jet parts, gemstones, and legal documents. The maximum single-cargo weight this facility can accommodate is 150 pounds. The cargo weighing more than 150 pounds is shipped by another FedEx division.

Exhibit 4.5-4: FedEx's Cessna 208 Air Cargo Aircraft

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

FedEx does not coordinate with Customs and Border Patrol at EYW. This occurs only at its larger hubs, such as at Memphis International Airport. However, the TSA does conduct random inspections.

Mountain Air's routine flight schedule to FLL consists of two arrivals in the morning between 9:00 a.m. and 9:30 a.m. The inbound cargo is unloaded onto FedEx trucks or vans, and the aircraft is reloaded with the outbound cargo destined for departure to FLL between 10:00 a.m. and 10:30 a.m. as shown on **Exhibit 4.5-5** and **Exhibit 4.5-6**. A second aircraft is staged on the apron during the day and is loaded with cargo for an evening departure at approximately 7:00 p.m.

Exhibit 4.5-5: FedEx Staging Trucks on Apron

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Exhibit 4.5-6: FedEx Staging Trucks on Apron to Unload Cargo

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Mobile roller beds are used to load and unload cargo on the apron, as shown on **Exhibit 4.5-7**. The warehouse building FedEx leases from EYW is used to hold packages for pickup and to sort outbound cargo utilizing tables and bins. Conveyor belts are not utilized. The vehicular fleet consists of 10 trucks and vans that are stored at EYW. During daylight operations, FedEx trucks and vans use Gate 1 on the eastside of EYW, as shown on **Exhibit 4.5-8**. During night operations, they are required to use a single point of entry at Gate 3 to the SIDA, as shown on **Exhibit 4.5-9**, which must be accessed from the west side of EYW via the AOA Gate 5.

Exhibit 4.5-7: Mobile Roller Beds and Hand Trolleys

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Exhibit 4.5-8: FedEx Trucks Use Gate 1

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Exhibit 4.5-9: Security Identification Display Area Gate 3

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

4.6.1.3 Potential Market Impacts

FedEx's Operations Manager at EYW anticipates that MIA will handle all inbound and outbound cargo for Cuba, because it is the Latin American base for FedEx. Martinaire did not respond to this question. However, both Martinaire and FedEx indicated that they anticipated increased growth in cargo due to the increasing popularity of ecommerce.

4.6.1.4 FedEx Cargo Volumes

The following cargo volume information was provided by FedEx during the Spring 2016 interview. FedEx staff stated that they handle approximately 872,000 pounds of cargo annually. They indicated that this equates to approximately 4,000 pounds per day. They further indicated that much of the daily volume is the result of the three military installations.

4.6.1.5 UPS Cargo Volumes

The following cargo volume information was provided by Martinaire staff during the Spring 2016 interview. Martinaire staff indicated that UPS's inbound cargo volume from MIA was 581,716 pounds in 2014. In 2015, they had experienced an increase to 606,436 pounds. The outbound volume between EYW and MIA in 2014 was 64,052 pounds. They did, however, experience a decrease in outbound cargo to 58,540 pounds in 2015. Martinaire staff indicated that they anticipate another increase in volumes for 2016.

4.6.1.6 Air Cargo Facilities Space Utilization

Table 4.5-1 summarizes the two cargo operators' facilities at EYW, which is based on the information obtained during the interviews and a review of lease documents. It presents a breakdown of the functional areas and dimensions for Martinaire and FedEx. The data show that Martinaire has no dedicated building space at EYW, because its operations occur on Signature Flight Support's apron. It should be noted that both air cargo operators stated that they did not need additional space.

Table 4.5-1: Facility Utilization Summary

OPERATOR	WAREHOUSE (SORTING)	APRON	EMPLOYEES	TRUCK/ VEHICLE AREA	AIRCRAFT	TRUCKS/VANS
FedEx	2,973 sq ft 2/	8,842 sq ft 2/	14	9,535 sq ft 2/	2–4	10
Martinaire/UPS	N/A	2,400 sq ft 1/	1 (pilot)	N/A	1	0

NOTES:

N/A – Not Applicable

1/ Based on information provided by Martinaire and Mountain Air staff.

2/ Based on Lease

SOURCE: Martinaire/UPS and FedEx staff
PREPARED BY: American Infrastructure Development, Inc.

4.6.1.7 Processing Times

FedEx has indicated that it takes approximately 1 hour to unload and load trucks, sort FedEx mail and cargo, and load and unload aircraft. UPS's cargo operator, Martinaire, has indicated that it takes UPS's staff approximately 30 minutes to load and unload aircraft.

Since the last update of the Master Plan in 2003, FedEx has been the sole air cargo operator with a facility on EYW. FedEx's Cargo Manager stated that the building was constructed in the early 1990s. UPS loads and unloads the aircraft, while the cargo operator, Martinaire, only provides pilots to transport the cargo. To facilitate this process, Martinaire subleases one aircraft parking position for the Cessna 208 Caravan on Signature Flight Support's apron.

UPS's cargo operator, Martinaire, has indicated that the current operation is satisfactory and profitable, and the operator does not anticipate the need for a cargo building at EYW. Martinaire also has the ability to park up to two aircraft on Signature Flight Support's apron, if needed. Since UPS only needs access to Signature's apron to load and unload air cargo, the remainder of Section 4 will focus on FedEx's air cargo operation.

4.6.2 DEMAND CAPACITY ASSESSMENT

The projected air cargo volumes on Table 2-21 entitled "All Cargo Volumes and All-Cargo Operations" in this Master Plan's forecast section showed a CAGR of 2.7 percent from 2015 to 2035. On the same Table 2-21, "All Cargo Aircraft Operations" column showed the same CAGR 2.7 percent. "Historic Aircraft Operations" on Table 2-10 of the Master Plan forecasts showed a CAGR of 2.8 percent from 2012 to 2015.

4.6.3 FACILITY REQUIREMENTS

The capacity of existing cargo processing facilities at EYW was also assessed. This assessment included future requirements for buildings, aircraft parking aprons, and ground access facilities. It has been determined that expanded air cargo facilities are not needed when applying air cargo standards based on the cargo volumes received from FedEx and UPS. In the event the assessment of facility requirements determined additional air cargo space is needed, on-Airport options were examined. One site considered was the vacant Airport property on the north side of the Runway 9 approach end. However, this land has several site constraints related to airport design setback requirements; consequently, there isn't adequate land to develop this site as a cargo facility. The following is an explanation of the planning standards that were used to make this determination.

4.6.3.1 Air Cargo Facilities Planning Standards

The *Air Cargo Guide* is one of many commonly used air cargo facility planning tools in the industry.[12] This document has been updated over the years by a consortium of airport and cargo planning experts. In the preamble of this guide, the following general observations, suggestions, and data needs are discussed as starting points for assessing air cargo needs at airports of all sizes:

- Airports are dynamic businesses, and competing forces may result in demand for additional land, which in many cases is a scarce commodity for many airports;
- Techniques must be identified and implemented to foster better utilization of the existing airport land;
- Information on current conditions is needed to identify operational and capacity management issues related to air cargo facilities' development;
- Market assessments are key to identifying geographic market size and growth potential;
- Market surveys of the target markets generate important data;
- Determining the flow of goods in the operating market (what, who, how, and when are commodities transported in the market); and
- What is needed to expand or retain air cargo.

4.6.3.2 Air Cargo Building Standards

In the "Air Cargo Facility Analysis" chapter of the *Air Cargo Guide*, it is explained that there is considerable variability in utilization rates for air cargo. These rates are measured by cargo tonnage. It is suggested that for smaller airports, the average utilization rate is approximately 0.5 tons (1,000 pounds) per square feet. For large airports, the utilization rate exceeds 1.0 ton per square feet. Since UPS does not have a cargo building at EYW, the utilization rate was applied to FedEx's building lease area of 2,973 square feet.[13] With this utilization rate, FedEx can handle approximately 1,500.0 tons of cargo, which is adequate to meet the forecast demand of 828 tons by 2035. FedEx stated that it processed 872,000 pounds (436.0 tons) of cargo in 2015.

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[12] Airports Council International – North America, *Air Cargo Guide*, December 2013.

[13] FedEx also uses a portion of its 8,842 square feet leased apron to process air cargo, since it doesn't use a conveyor system at EYW.

4.6.3.3 Aircraft Parking Standards

FedEx leases 8,842 square feet of apron for aircraft parking, cargo staging, and for the unloading and loading of trucks and aircraft. During off-peak times, FedEx has two aircraft on the apron. The parking envelop for the two Cessna 208 Caravans is approximately 7,000 square feet, including wingtip clearance. During the Fall 2016 interview, FedEx stated that its apron space was adequate.

4.6.3.4 Recommendations

EYW is a commercial-service airport consisting of 334 acres of land; consequently, land is a finite resource. Off-Airport expansion is extremely limited given its proximity to the Atlantic Ocean, abutting land uses, historic properties, and protected preservation areas. Given these conditions, there is limited opportunity on the landside and the airside for air cargo expansion. Despite these constraints, it has been determined that both cargo handlers at EYW have devised very efficient operations that are responding to the current Key West market. In fact, based on the demand/capacity and facilities requirements assessment, the on-Airport air cargo facilities have adequate capacity.

It is suggested that EYW continue to monitor air cargo activity, keep an ongoing dialogue with the current air cargo operators, coordinate with the Chamber of Commerce, and consider developing an Airport-wide strategic business plan and economic impact study that will assist the stakeholders in developing an air cargo development program. Due to EYW's limited land area, future projects will be competing for development space and should not be allowed to inadvertently restrict air cargo operation and growth. When viewing the existing and future air cargo volumes at EYW, and the fact that UPS and FedEx ship significantly more cargo than the passenger airlines, EYW should ensure that they can continue to operate efficiently.

4.7 General Aviation

The following sections will compare the forecast GA demand to the existing capacity of GA facilities available at the Airport. This comparison is used to determine future facility requirements and to ensure the Airport is positioned to serve forecast activity levels over a 20-year planning horizon. To accomplish this, three distinct elements are examined:

- Aircraft storage and hangar facilities
- Aircraft ramp and parking area
- FBO facilities, landside access, and vehicle parking areas

4.7.1 AIRCRAFT STORAGE AND HANGAR FACILITIES

GA hangars at an airport are planned for both based and itinerant aircraft. Requirements are calculated based on the size and quantity of aircraft based at the Airport. Given the warm and sunny, coastal climate at EYW, it is typical for a large percentage of the aircraft based at the Airport to be regularly stored in hangars. Records show that 65 to 75 percent of the based aircraft are stored within some type of hangar facility at any given time. All based jet aircraft and rotorcraft are stored in hangars. As such, it is assumed for the purpose of planning hangar space requirements that 70 percent of all future based single-engine and multi-engine aircraft and all jet and rotorcraft will require indoor hangar facilities. Although each aircraft at the Airport will vary in size, the following planning factors were used to calculate future hangar space requirements:

- 1,200 square feet for single-engine and rotor aircraft
- 1,600 square feet for multi-engine aircraft
- 3,200 square feet for jet aircraft

The forecast for based aircraft reflects stable growth for all aircraft types over the planning period. Multi-engine and jet aircraft, however, will account for the majority of based aircraft growth at the Airport, as they are forecast to increase from 11 to 23 and 4 to 8, respectively. The overall hangar requirements are presented in **Table 4.6-1** and **Table 4.6-2**. Included in the hangar demand is an additional 10 units for small aircraft to address the current (August 2016) hangar waiting list of 10 individuals. Further, to provide for the indoor storage of up to 4 transient jet aircraft, an additional 13,000 square feet of conventional hangar space is depicted in all years.

When considering existing conventional hangar space at EYW, just over 18,000 square feet is available. This includes the two hangars (12,000 square feet and 6,200 square feet), as described in Section 2.5.3.2. Presently, individual unit hangars at EYW include 11 nested T-hangars and 8 small-box hangars across four buildings, as described in Section 2.5.3.1.

Table 4.6-1: Aircraft Hangar Requirements—Individual Unit Hangars

	2015	2020	2025	2035
Based Aircraft	58	63	67	79
Based Aircraft in Hangar	42	46	49	58
Individual Unit Hangars Required	19	26	29	34
+ Hangar Waiting List (10 Units)	29	36	39	44
Existing Individual Unit Hangars	19	19	19	19
Surplus/(Deficiency)	10	(17)	(20)	(25)

SOURCE: McFarland Johnson, Inc. September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

Table 4.6-2: Aircraft Hangar Requirements—ClearSpan Hangars

	2015	2020	2025	2035
Based Aircraft	58	63	67	79
Based Aircraft in Conventional Hangar	23	20	20	24
Single-Engine Aircraft – Square Feet Required	12,480	7,224	5,544	3,948
Multi-Engine Aircraft – Square Feet Required	12,320	12,544	13,440	18,032
Jet Aircraft – Square Feet Required	12,800	16,000	19,200	25,600
Helicopter – Square Feet Required	1,200	1,200	1,200	1,200
Total Square Feet Required	38,800	36,968	39,384	48,780
Plus Transient Need (13,000 Square Feet)	51,800	49,968	52,384	61,780
Existing GA Hangars Square Feet	18,200	18,200	18,200	18,200
Surplus/(Deficiency) Square Feet	(33,600)	(31,768)	(34,184)	(43,580)

SOURCE: McFarland Johnson, Inc., September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

4.7.1.1 Recommendation

The existing GA demand for hangar space exceeds current capacity for both individual-use hangars (T-hangar units and small-box hangars) and space within a multiuser ClearSpan hangar. To adequately provide for the forecast demand through the planning period ending in 2035, the Monroe County should plan for an additional 11 individual-use hangars, as well as an additional 40,000 to 45,000 square feet of ClearSpan hangar space.

4.7.2 GENERAL AVIATION AIRCRAFT RAMP AND PARKING AREA

Given the wide variety of aircraft that can be categorized as GA, the planning of GA aprons is largely dependent on aircraft parking demand and aircraft movements. There are four components that typically determine the required apron area for GA uses: based-aircraft parking, itinerant aircraft parking (transient apron), aircraft fueling apron, and staging and maneuvering areas. The sum of these components determines the total area of apron required to meet the forecast level of GA demand at EYW.

4.7.2.1 Based and Itinerant Aircraft Parking

For planning purposes, based and itinerant GA aircraft apron requirements are usually considered separately, since they serve different functions and support users with varying levels of familiarity with the airfield and its GA facilities. Historically, a significant number of based aircraft have been stored in conventional hangar or T-hangar storage, as opposed to parked on the apron. Records have shown that anywhere from 25 to 35 percent of based aircraft could be stored on the apron at any given time. Therefore, it is assumed that 30 percent of future based aircraft will regularly require apron space.

Planning metrics to estimate the apron space required for itinerant aircraft parking are provided in Airport Cooperative Research Program (ACRP) Report 96, *Apron Planning and Design Guidebook*. This report states that approximately 110 square yards of apron space should be provided for ADG I aircraft and 165 square yards for ADG II aircraft when an adjacent taxilane is provided. However, to account for maneuvering space on the apron, these values were increased to 300 square yards for ADG I aircraft and 600 square yards for ADG II aircraft when providing for Group II separation.

As detailed in Section 2.5.2, the main GA apron spans approximately 26,500 square yards while three auxiliary GA aprons total an additional 17,700 square yards. This space, however, is inclusive of staging and maneuvering area in front of apron-fronting hangars. **Table 4.6-3** presents the required GA apron space strictly for the parking and tying down of aircraft at EYW with the following assumptions:

- Adequate apron area must be reserved for all based aircraft not stored in hangars, as well as peak period itinerant aircraft, without limiting access to or utility of the hangars adjacent to the apron area.
- The percentage of based aircraft not stored in hangars (30 percent) will be maintained throughout the forecast period.
- The peak period for apron utilization is calculated by applying a multiplier of 2 to the peak hour calculation for itinerant aircraft to account for peak periods that extend beyond a single hour.
- Group I aircraft represent 40 percent of the total aircraft calculated to require apron space during the peak period and require 300 square yards of apron space each to provide for tie-down area, safety clearances, and movement area.

- Group II aircraft represent 60 percent of the total aircraft calculated to require apron space during the peak period and require 600 square yards of apron space each to provide for tie-down area, safety clearances, and movement area.
- As apron space is an imperative element to overall airfield utility and capacity, a 20 percent buffer will be applied to the calculation of apron requirements in order to ensure ample apron space is provided over the planning period.

Table 4.6-3: General Aviation Apron Space Requirements—Parking and Tie-Down

	2015	2020	2025	2035
Based Aircraft	58	63	67	79
Based Aircraft on Apron (30% of Based Aircraft less Jet and Helo)	16	17	18	21
Itinerant Aircraft – Peak Period (2*Peak Hour)	18	20	22	26
Total Aircraft Parked on Apron	34	37	40	47
Total Required GA Apron (Square Yards)	16,272	17,808	19,200	22,560
Total Required GA Apron + 20% Buffer (Square Yards)	19,526	21,370	23,040	27,072
Existing GA Apron (Square Yards)	44,200	44,200	44,200	44,200
Surplus/(Deficiency) (Square Yards)	24,674	22,830	21,160	17,128

SOURCE: McFarland Johnson, Inc., September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

4.7.2.2 Aircraft Fueling Apron

Presently, GA aircraft are fueled through the use of fuel trucks owned and operated by Signature Flight Support. It is recommended that space be reserved if the GA apron is further developed to support a self-service fuel farm with one 3,000- to 5,000-gallon tank specifically for the use of GA aircraft. The fueling facility would require sufficient apron space to fuel one of the Airport's larger GA aircraft users and at the same time provide adequate room and separation to stage one waiting aircraft of the same type. Based upon the dimensions of a Beechcraft King Air (B350/B300/B200/B100), an aircraft that operated over 15 times per week (780 annual operations) at EYW in 2015, an area of approximately 1,200 square yards should be reserved for the fuel facility to provide room for one aircraft to fuel while another waits. In addition, room should be reserved for a containment area for Spill Prevention and Countermeasure and Control (SPCC), per the National Air Transportation Association (NATA) and the Environmental Protection Agency (EPA). The containment area should consist of a pad large enough to accommodate the fuel truck, a collection system, valve box, and containment area.

4.7.2.3 Staging and Maneuvering Areas

Adequate space for the safe maneuvering of aircraft in and around hangar facilities must also be included in any forecast of apron requirements. Staging and maneuvering is most closely associated with the provision of space in front of conventional ClearSpan hangars. Currently, sufficient staging and maneuvering space is available on each of the aprons providing access to hangars at EYW. The presence of staging and maneuvering space, however, can hinder the amount of space for the parking of aircraft. This is particularly evident when aircraft park near the FBO Terminal/Office building, causing the potential to restrict access to the conventional and box hangars located just west of that building. Adequate staging and maneuvering space for these hangar facilities, as well as the access roadway intercepting the apron at Security Gate #5, would limit aircraft parking positions in front and to the northwest of the FBO Terminal/Office building to as few as two. As additional hangars are constructed at the Airport, it is recommended that these hangars provide sufficient staging and maneuvering apron, comparable to the size of the hangar, while not significantly impacting the layout and the availability of space for aircraft parking. Based on the facility requirements for aircraft hangars at the Airport, approximately 6,500 square yards of additional apron will be necessary for staging and maneuvering through the planning period.

4.7.2.4 Recommendations

While the analysis does not indicate a need for additional apron capacity for based and transient aircraft, operational restrictions to both the GA apron and commercial service apron have been noted as a result of the physical fence that separates and distinguishes these two apron spaces. As commercial operations continue to grow at EYW, portions of the existing GA apron, including the area currently leased by Signature Flight Support east of the commercial aircraft parking positions, will need to be reallocated for commercial use. Removal or reconfiguration of the on-apron fence will increase mobility of all aircraft and enable commercial operations to utilize apron space when there is overflow during times of peak activity. The development of a separate GA fueling apron should be considered, with approximately 1,200 square yards designated for the parking of two GA aircraft. Additional staging and maneuvering space should be constructed as part of any additional hangar construction at EYW.

4.7.2.5 Terminal

A GA terminal provides space for offices, waiting areas, flight planning, concessions, storage, and other amenities for pilots and passengers. GA terminals also provide the first and last impression of the Airport and local area that GA pilots and passengers experience. The following analysis was conducted to estimate the amount of space that should be considered to accommodate the pilots/passengers expected during the planning period. An estimate of the peak hour GA pilots/passengers is necessary to determine the number of people that would use the GA terminal facilities during a 1-hour period. To estimate the peak hour pilots/passengers and explore gross GA terminal spatial requirements, guidance from ACRP Report 113, *Guidebook on General Aviation Facility Planning*, was utilized and the following methodology was applied, with results shown in **Table 4.6-4**

- The number of operations conducted during the peak hour of the average day during the peak month was calculated using data from the forecasts presented in Section 3. It was assumed that arriving and departing GA pilots/passengers could use the terminal at the same time. Likewise, both local and itinerant operations would require terminal space at the Airport.
- Though there is limited flight training activity at EYW, peak hour operations were reduced by 10 percent to eliminate any activity associated with pilot training. While training operations require terminal space (e.g., flight planning, meeting with flight instructor, restrooms, etc.), not all have a direct relationship.

- The adjusted peak hour operations (arriving or departing) were estimated to have an average of 2.5 people on board (pilots and passengers). A staff assumption of 6 was also added.
- An area of 150 square feet was used for each peak hour pilot/passenger to determine the terminal space requirements. This value accommodates all functions of a full-service GA terminal building, including FBO counter space, waiting area, snack room, office space, pilot's lounge, restrooms, training area, circulation space, etc.

Table 4.6-4: Terminal Gross Area Analysis

	PEAK HOUR OPERATIONS	ADJUSTED OPERATIONS	NUMBER OF PEOPLE	TOTAL TERMINAL SPACE DEMAND (SQ FT)	SURPLUS/ (DEFICIENCY)
Base Year					
2015	11	10	31	4,613	(2,431)
Forecast					
2020	12	11	33	4,950	(2,750)
2025	13	12	35	5,288	(3,088)
2035	15	14	40	5,963	(3,763)

SOURCE: McFarland Johnson, Inc., September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

The existing FBO terminal is approximately 2,200 square feet in size and includes a lounge, restroom, flight planning area, training room, reception area, conference room, private offices, and employee space. Approximately 1,600 square feet is available for Airport guests and aircraft passengers. As evident by the analysis presented, the existing terminal space is operating beyond its capacity during times of peak activity. Therefore, a new or expanded GA terminal facility should be considered. In addition to being undersized, the existing FBO terminal building is nearing 30 years old; while it was refurbished in 2013, the building is not anticipated to remain viable through the 20-year planning period in its present condition and configuration.

4.7.2.6 Access and Parking

Fixed Base Operator Landside Access

As described in Section 2.5.1, Signature Flight Support is the sole FBO at EYW and operates from two main buildings, including a small FBO office building and the FBO's maintenance hangar. These facilities are only accessible via Faraldo Circle, using the main Airport entrance, and then continuing on to Cabanas Way. This requires the driver to travel through the terminal departures roadway to gain access to the FBO parking area. This situation is less than ideal as it increases the utilization of the terminal departures roadway beyond what the terminal demand would require alone; it could, over time, add to congestion at the terminal curb. While direct access to the FBO parking area from South Roosevelt Boulevard would be ideal, spatial and environmental conditions within the vicinity are constraining factors.

Vehicle Parking

West of Faraldo Circle and accessible via Cabanas Way exist three distinct parking areas, all of which are available to GA users. In total, the area provides approximately 50 vehicle parking spaces. The number of parking spaces to be required in the future is primarily based on the level of peak-hour GA activity. The following methodology is based on a previously completed Aircraft Owners and Pilots Association Survey that found an average of 2.5 persons aboard the typical GA operation. Vehicle parking requirements for GA activities are displayed in **Table 4.6-5**.

- Determine the number of peak hour GA operations for based aircraft by taking 25 percent of the peak month average day itinerant operations and 100 percent of peak month average day local operations and assuming 12 percent of those operations occur within the peak hour.
- Determine the number of peak hour GA operations for transient aircraft by taking 75 percent of the peak month average day itinerant operations and assuming 12 percent of those operations occur within the peak hour. It is assumed that these aircraft, while not based at EYW, will be picking up passengers at the Airport and will require parking spaces.
- Determine the number of peak-hour pilots and passengers by multiplying the number of peak hour operations by 2.5.
- Estimate the number of parking spaces in use by assuming that parking demand will be half the number of pilots and passengers, since parking spaces will be utilized only by departing pilots and passengers.
- Multiply by a contingency factor of 1.3 to account for on-site employees requiring use of the GA parking area and also to allow for parking flexibility during times of above average demand.

Table 4.6-5: Vehicle Parking Space Requirements for General Aviation Users

YEAR	GA PEAK HOUR OPERATIONS	GA PEAK HOUR OPERATIONS (BASED)	GA PEAK HOUR OPERATIONS (TRANSIENT)	PILOT AND PASSENGER PARKING DEMAND	CONTINGENCY	TOTAL PARKING DEMAND	EXISTING PARKING SPACES	SURPLUS/ (DEFICIENCY)
2015	11	4	7	29	1.3	37	50	13
2020	12	4	8	30	1.3	39	50	11
2025	13	5	8	32	1.3	42	50	8
2035	15	5	9	36	1.3	47	50	3

SOURCE: McFarland Johnson, Inc. September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

As shown, 47 vehicle parking spaces are identified to be required for GA purposes through 2035. Although this requirement supports GA aircraft utilizing all three of the GA aprons, two of which being located far from the parking area, no separate parking facilities are proposed. As a result of the existing layout of the airfield and the limited accessibility as a result of the inland salt ponds comprising much of the southeast quadrant of the airfield, vehicular access to the easternmost GA apron areas is infeasible. However, with the development of any additional GA hangar facilities, additional GA parking should be considered.

4.7.2.7 Recommendations

It is recommended that either a new GA terminal of approximately 6,000 square feet of publicly accessible area be constructed or the existing terminal be similarly expanded. Additionally, opportunities to provide direct access to GA facilities and vehicle parking areas where GA users are not required to traverse the terminal frontage loop road should be explored. Providing direct access to GA areas in this way would better serve the GA users and disburden the vehicular demand at the terminal curb. Lastly, with the addition of any new hangar space, new vehicular parking space should be provided.

4.7.3 SUMMARY OF GENERAL AVIATION FACILITY REQUIREMENTS

Several requirements for GA facilities have been discussed in the preceding sections. A summary of the key requirements are presented in **Table 4.6-6**.

Table 4.6-6: Summary of General Aviation Facility Requirements

ITEM/FACILITY	EXISTING FACILITY OR CAPACITY	ULTIMATE REQUIREMENT (2035)	DEFICIT
GA T-Hangar Units	19	44	25
GA Conventional Hangar Space (Square Feet)	18,200	61,780	43,580
GA Aircraft Parking Apron	44,200	27,072	None
GA Fueling Apron	0	1,200	1,200
FBO Terminal	2,200	6,000	3,800
GA Vehicle Parking	50	47	None

SOURCE: McFarland Johnson, Inc. September 2016.
PREPARED BY: McFarland Johnson, Inc., September 2016.

4.8 Support Facilities

Support facilities provide essential, core services needed for the safe and efficient operation of airports. Support services will vary based on the type of airport and the amount of passenger and aircraft activity. An assessment of these services has been conducted to determine if they are adequately meeting the current needs of EYW, or if improvements are needed for meeting an acceptable performance level. They have also been evaluated to determine if the services they currently provide will be compatible with forecast airport growth and recommended development. The following support facilities are discussed in this section of the Master Plan: fuel storage facility; ARFF; Monroe County Sheriff's Office, Airport Security Division; U.S. CBP facility; airport maintenance facilities; and the ATCT. **Exhibit 4.7-1** shows the on-Airport location for the current facilities.

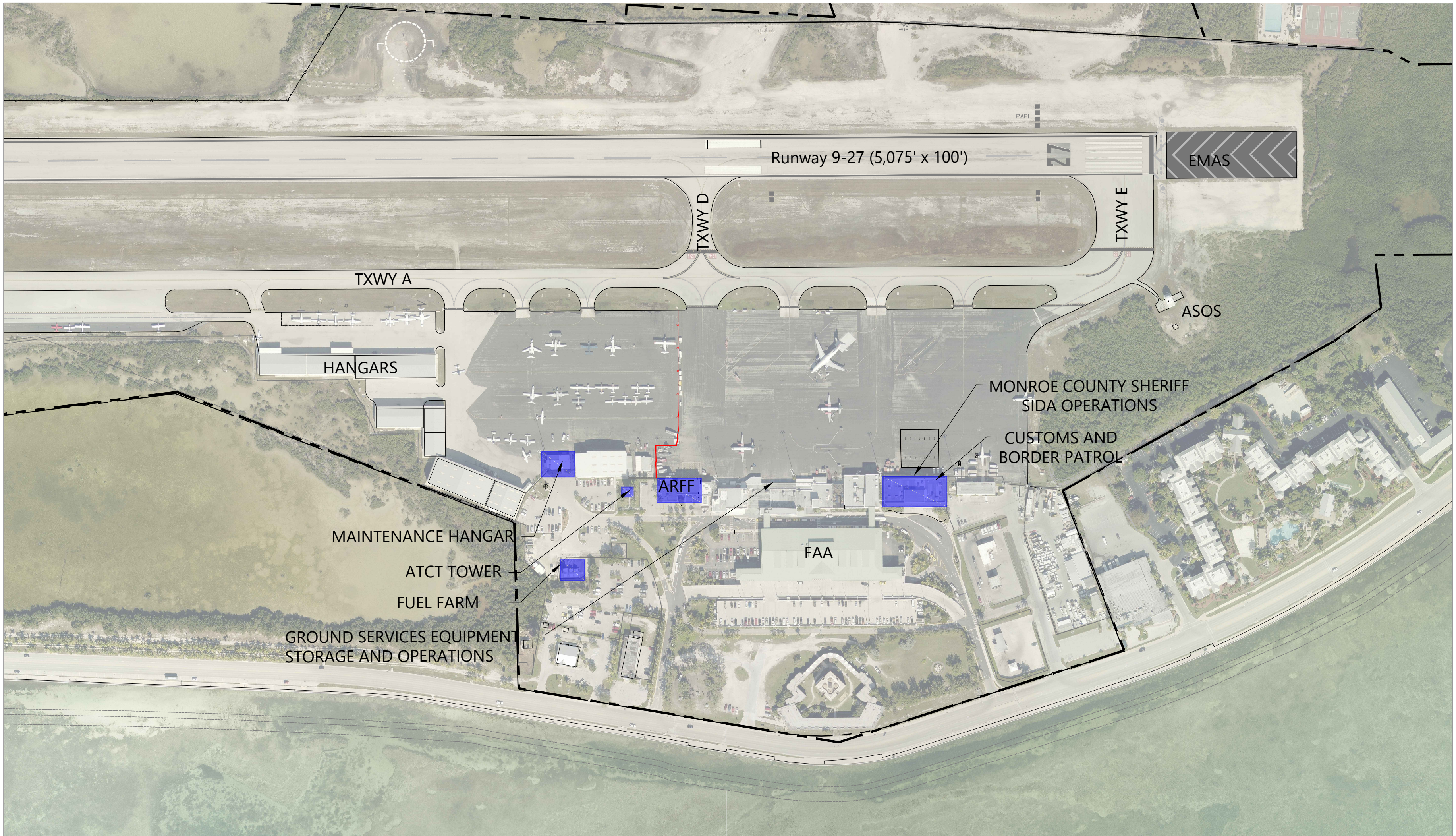
4.8.1 DEMAND/CAPACITY ASSESSMENT

Using FAA regulations, Florida Department of Transportation (FDOT) guidance, ACs, and information provided by airport users, the following facilities were examined to determine if they are meeting the current and future needs of EYW: the existing fuel storage facility; the ARFF; the Monroe County Sheriff's Office, Airport Security Division; the U.S. CBP; the airport maintenance facilities; and the ATCT. Areas of concern that may have been raised by managers during the on-site and follow-up interviews were also addressed. The following subsections provide a description of each facility, as well as the standards that were used to evaluate each facility.

4.8.1.1 Fuel Storage Facility

The fuel storage facility is also referred to as a fuel farm. The fuel farm at EYW is owned and operated by Signature Flight Support. It consists of three 12,000-gallon aboveground tanks (see **Exhibit 4.7-2**). Two of these tanks contain Jet A fuel, and the third contains 100LL fuel for piston-powered aircraft. The fuel farm includes three fueling racks that can be used concurrently by up to five trucks. Three of the fuel trucks contain 5,000 gallons of Jet A fuel, while the remaining two trucks contain 1,000 gallons of 100LL fuel. Signature Flight Support staff did not identify concerns or issues that should be addressed as part of the update of the Master Plan.[14]

[14] General Manager, Signature Flight Support, February 29, 2016.



SOURCE: Basemap and Aerial Photography, Jacobs, September, 2015
PREPARED BY: American Infrastructure Development, Inc., November, 2016.

EXHIBIT 4.7-1

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On Airport Support Facilities Locations

Drawing: D:\Dropbox (AID)\1-PROJECTS\EYW\JAC16024-Airport-Master-Plan\03-Drawings\WIP\4.7-1 EYW-SUPP-FAC-LOCS.dwgLayout: 11x17L Plotted: Jan 18, 2017, 02:47PM

Exhibit 4.7-2: Fuel Storage Facilities

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

Since the 2003 Master Plan's Fuel Farm Facility Inventory and Facility Requirements Evaluation, there has been no change to the fuel farm's tank capacity. At the time, the fuel farm consisted of three 12,000-gallon aboveground tanks, with two of the tanks containing Jet A fuel and one containing Avgas. The fuel farm had three fueling racks that were used by four trucks (five currently). Two of the fuel trucks contain 3,000 gallons of Jet A fuel (currently three fuel trucks contain 5,000 gallons of Jet A). The remaining two trucks contained 1,200 gallons of Avgas (currently two trucks contain 1,000 gallons of 100LL fuel).

The County's requirements for EYW's fuel storage facility specify that the FBO comply with standards for managing the fuel farm tank and for refueling vehicles.[15] The FBO must provide and maintain a minimum of 20,000 gallons of aviation fuel storage capacity for each grade of aviation fuel that is usually required for aircraft using EYW. The requirements also state that 100 octane aviation gasoline and Jet A aviation kerosene base fuel should always be available; the FBO will provide an adequate number of fueling trucks with the volume and pumping capacity to sufficiently service the aircraft normally using EYW; and the FBO will provide and maintain pumping equipment with a pumping efficiency and capacity that is sufficient to service the aircraft normally using EYW. Based on the information provided by Airport staff, the current FBO is exceeding these minimum standards.

During follow-up interviews with Senior Operations Management staff at the airport, a concern was raised about providing direct access for fuel trucks to the fuel farm. Currently, the fuel trucks must use the same landside roadway system that passengers use to access the terminal complex. These trucks are just below the height restrictions needed to clear the connector walkways between the departure level and the arrivals area of the

[15] Resolution No. 374-1990 A Resolution Of The Board Of County Commissioners Of Monroe County Florida Approving The Revised Minimum Standards For Commercial Aeronautical Activities By Fixed Base Operators And Other Aeronautical Service Providers At Monroe County Airports, The Board Of County Commissioners Of Monroe County Florida, August 1, 1990.

terminal. Operations staff has estimated that these trucks transport fuel to the fuel farm site approximately five to seven times daily. Identifying an alternate route for these fueling trucks would be desirable to enhance safety in the terminal area because they are transporting large quantities of highly flammable materials.

4.8.1.2 Air Rescue and Firefighting Facility

In 14 CFR Part 139, *Certification of Airports*, an ARFF index table specifies the type of facility and equipment best suited to provide rescue and firefighting activities at a commercial service airport. These standards are based on the type and dimensions of the largest and most frequently flown aircraft at an airport, as well as based on the number of average daily departures. Based on these standards, EYW is classified as an ARFF Index B airport. This means that the ARFF can respond to emergencies for aircraft at least 90 feet long but less than 126 feet long. In the case of EYW, this would include Boeing 737 aircraft. To enforce compliance with the ARFF index and many other requirements, the FAA conducts annual, comprehensive inspections of all airports certificated under 14 CFR Part 139.

The EYW ARFF facility is operated by the Monroe County Fire Rescue/Key West International Airport, Station 7; in addition to ARFF services, it provides fire suppression and emergency medical services. The ARFF has 13 fire fighters; 3 to 4 are on duty for a 24-hour shift, 365 days per year. The ARFF facility is located on the east side of the ATCT. This facility has three vehicle bays, two ARFF vehicles, a quick response vehicle, and a backup inspections vehicle (see **Exhibit 4.7-3**). The ARFF vehicles carry specified quantities of water, aqueous film-forming foam chemicals, dry chemical fire retardants, and nitrogen and halotron as the firefighting propellants.

Exhibit 4.7-3: Aircraft Rescue and Firefighting Facility

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

The FAA has stated that the primary objective in locating and orienting an ARFF station is to provide a timely response, protect life and property, and minimize the effects of an aircraft accident or incident or a catastrophic event occurring primarily on airport property. Consequently, the evaluation of the existing ARFF in this Master

Plan is focused on the operational criteria provided in FAA AC 150/5210-15A, Aircraft Rescue and Firefighting Station Building Design. This AC provides guidance on the siting, design, and operation of an ARFF consistent with the requirements under 14 CFR Part 139. EYW's ARFF was evaluated using the following operational criteria:

- Immediate, straight access to the airfield network.
- Unimpeded access routes with minimum turns to the airfield network and aircraft aprons.
- Direct access to the terminal aprons, minimizing the crossing of active runways, taxiways, or difficult terrain. This parameter is critical because of the need for a timely, safe response to emergencies on the ramps, aprons, or terminal areas. Response routes that do not require ARFF vehicles to enter the aircraft movement area will reduce the risk of airfield incursions.
- Non-interference with the ATCT's line of sight.
- Maximum surveillance of the airfield.
- Adherence to the building restriction line, as determined using AC 150/5300-13, Airport Design.

Based on site visits and a tour of the ARFF in the spring of 2016, the aforementioned operations criteria in AC 150/5210-15A are met.

4.8.1.3 Monroe County Sheriff's Office, Airport Security Division

The importance of Airport security is paramount to the continued safe operation of EYW. The Monroe County Sheriff's Office, Airport Security Division is in the Annex building; it contains offices, a breakroom, and a security office (see **Exhibit 4.7-4**). The Security Division provides landside and airside security for EYW, such as coordinating the badging function and the Security Identification Display Area training for airport employees and contractors. The Security Division provides security at EYW 24 hours per day, 7 days per week. ASTs monitor cameras and computerized door access alarms in EYW's Security Department Control Room. Additional sheriff's deputies and ASTs are stationed at the gate between the general aviation and commercial ramp areas to check cargo and to authorize access to the secured area of the commercial ramp. They also patrol the perimeter of EYW, assist passengers as necessary, and enforce the ground transportation rules of EYW. EYW's Security Division has 24 staff who report to the Director of Airport Security.

The location of EYW's Security Division facility must be visible, centrally located, and located near the various Airport departments, agencies, the passenger terminal, and other landside and airside facilities they interface with, monitor, and protect. The Security Division's current location meets these criteria.

Exhibit 4.7-4: Monroe County Sheriff's Office, Airport Security Division

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

4.8.1.4 U.S. Customs and Border Patrol

Aircraft arrivals from the Caribbean have increased the need for improvements to the U.S. CBP facility. There is also the potential for increased air service to Cuba.

On January 14, 2011, President Obama directed the State, Treasury and Homeland Security Departments to take steps to change regulations and policies so that they would allow U.S. airports to provide services to licensed charters for flights to Cuba. In order to take advantage of this opportunity to provide the community with this new air service, the airports must be international and have adequate customs and immigration capabilities.[16] Consequently, EYW started the process to be designated a Port of Entry by the CBP. CBP approved EYW as a Port of Entry in October 2011 with the capability to process 10 passengers and flight crew from Cuba at a time.[17]

Airport management is expecting the flights to and from Cuba to increase as more airline routes are approved by the United States Department of Transportation (USDOT). For example, in March 2016, the busiest airline at EYW, Silver Airways stated in a local news article[18] that it wanted to fly to destinations throughout Cuba. That airline currently flies 34-passenger twin-propeller charter aircraft. The airline indicated that it had started the application process with the USDOT to fly from five Florida airports to 10 destinations in Cuba. The airline's strategy was to provide convenient, direct service to smaller communities throughout Cuba from EYW, as well

16 White House, Office of the Press Secretary, January 14, 2011 Release entitled, "President Obama Announces New and Expanded U.S. Travel Regulations to Cuba"

17 The Associated Press, "First Commercial Flight from Key West to Cuba In More Than 50 Years Takes Off", December 30, 2013

18 Kevin Wadlow, Keynoter, "Silver Airways wants Cuba route from Key West", March 5, 2016

as from other Florida airports. Airport officials recognized the benefits of this expanded international service by one of its dominant airlines, as well as recognized the implication that other airlines would follow suit.

In anticipation of expanded international air service beyond the ability of the current U.S. CBP's ability to process, the County has accelerated a multi-phase construction project to increase the capacity of the U.S. CBP facility. The County is currently in the process of expanding the facility to accommodate current and future passenger demand.

The current U.S. CBP facility functions as a Port of Entry. This means that the facility is a controlled point of entry into the United States from foreign countries. It provides an inspection point for various agencies for the enforcement of immigration laws, customs regulations, and agricultural import restrictions. Given the interest in increasing international service by airlines currently operating at EYW, the U.S. CBP facility must be able to process larger aircraft.

The U.S. CBP facility is located within the Annex building (see **Exhibit 4.7-5**). It is open Monday through Saturday from 8:00 a.m. to 8:00 p.m. and closed on Sunday. The U.S. CBP has 13 employees. Its interior space consists of offices, a breakroom, and waiting areas and other ancillary uses. The U.S. CBP has direct access to the apron for conducting aircraft inspections. The U.S. CBP staff has indicated that the existing EYW facility does not meet current Department of Homeland Security standards. The facility has the capacity to process general aviation and charter aircraft passengers entering the United States, but it does not have the capacity needed to process passengers from commercial flights. The current processing rate is 10 international passengers per hour.

Exhibit 4.7-5: U.S. Customs and Border Patrol

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

The County conducted a study in 2013 that resulted in a recommended renovation and expansion program for the U.S. CBP facility, and this expansion program is currently being implemented. The size of the U.S. CBP will increase from 9,392 square feet to 14,744 square feet.

4.8.1.5 Airport Maintenance Facility

Airport maintenance facilities at EYW are not housed in a free-standing building. Instead, many of their functional and storage areas are decentralized due to a lack of space. There are currently five employees who work the following three staggered shifts: 7:00 a.m. to 4:00 p.m., 8:00 a.m. to 5:00 p.m., and 9:00 a.m. to 6:00 p.m. A janitorial contract supplements the services for the passenger terminal and offices, and there is a landscaping contractor for the airfield and landside areas. The janitorial staff has offices and cleaning supply storage in the passenger terminal.

The staff performs routine maintenance on their equipment and trucks. However, they use the services of the Monroe County Public Works Department to repair their vehicles. The Monroe County Public Works Department is located on the east side of the airport.

Airport maintenance is responsible for airside and landside repairs, maintenance, and recycling. It will incur additional responsibilities and storage needs associated with maintaining the runway's new PAPI navigation aid after the VASIs are removed. The FAA currently maintains the VASIs.

The primary office for Airport maintenance is in the administrative offices of the Annex building. The space is on the upper level and comprises two offices and a common area; it is approximately 375 square feet. Airport maintenance staff parks in the space assigned to Airport employees next to the Airport Administration building.

Airport maintenance also has a maintenance shop in the arrivals Annex of the Administration building. This space contains the breakroom, lockers, and storage. The vehicles and equipment are stored in the lower level of the passenger terminal garage on the southwest end. Due to passenger parking demand, this storage space has been reduced. In this area, Airport maintenance stores an airfield pickup truck, two County trucks, one sweeper, trailers, excavators, traffic cones, and other equipment. It is estimated that this storage area is 2,400 square feet (or six vehicular parking spaces with a 10-foot back-out lane). Storage is not provided for airfield mowing, since it is contracted to a private company.

An interview with Airport maintenance staff was contacted in the Fall of 2016 to obtain input regarding how they operate within their current facilities and what recommended actions could enable them to continue their desired level of service. When asked if the maintenance staff had grown since the last update to the Master Plan and if there were plans to expand their staffing level, staff indicated that the number of maintenance staff has remained constant since the construction of the current terminal in 2009.

When asked about the location and adequacy of space, staff indicated that their location for various functions was decentralized due to not having a consolidated Airport maintenance facility. (See **Exhibit 4.7-6**). Also, decentralized locations and inadequate storage space for their supplies and equipment were creating a challenge. To perform routine maintenance and work order repairs expeditiously, parts and materials need to be readily available. However, they do not have the space to warehouse these items, which are spread out throughout the Airport property. For example, the electrical room is in one location, and there are three Connex storage containers (approximately 300 square feet each) near the fuel farm. In addition to centralizing these areas, the staff felt a maintenance garage was needed to store their vehicles and to conduct routine maintenance. Portable lockers for warehouse supplies would also be helpful.

Exhibit 4.7-6: Location of Airport Maintenance Facilities Storage Area in Passenger Terminal Garage

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

4.8.1.6 Air Traffic Control Tower

The EYW ATCT was constructed in 1973 (See **Exhibit 4.7-7**). The ATCT is part of the FAA's contract tower program. It is operated by RVA Robinson Aviation, Inc. during the hours of 7:00 a.m. to 9:00 p.m. every day except Sunday. RVA Robinson Aviation, Inc. has five employees. The ATCT is located on the west side of the ARFF building. Six parking spaces are provided at this facility.

During an interview with the ATCT staff in the spring of 2016, their management indicated that renovations and upgrades to the ATCT facilities had been programmed by the federal government, and authorization was anticipated. Follow-up attempts were made to obtain more information from Airport staff. However, beyond the need to update a facility constructed in the 1970s, specific information was not available.

Exhibit 4.7-7: Air Traffic Control Tower

SOURCE: American Infrastructure Development, Inc., 2016.
PREPARED BY: American Infrastructure Development, Inc., 2016.

4.8.2 FACILITY REQUIREMENTS

There were no major capacity issues identified for the support facilities at EYW. Facilities such as those for the ATCT and the U.S. CBP are already in the process of being expanded to enhance their operations and to accommodate growth. All the other facilities discussed in this section are successfully fulfilling their missions. The following recommendations are offered to augment the continued good level of service the facilities provide as EYW experiences future growth.

4.8.2.1 Fuel Storage Facility

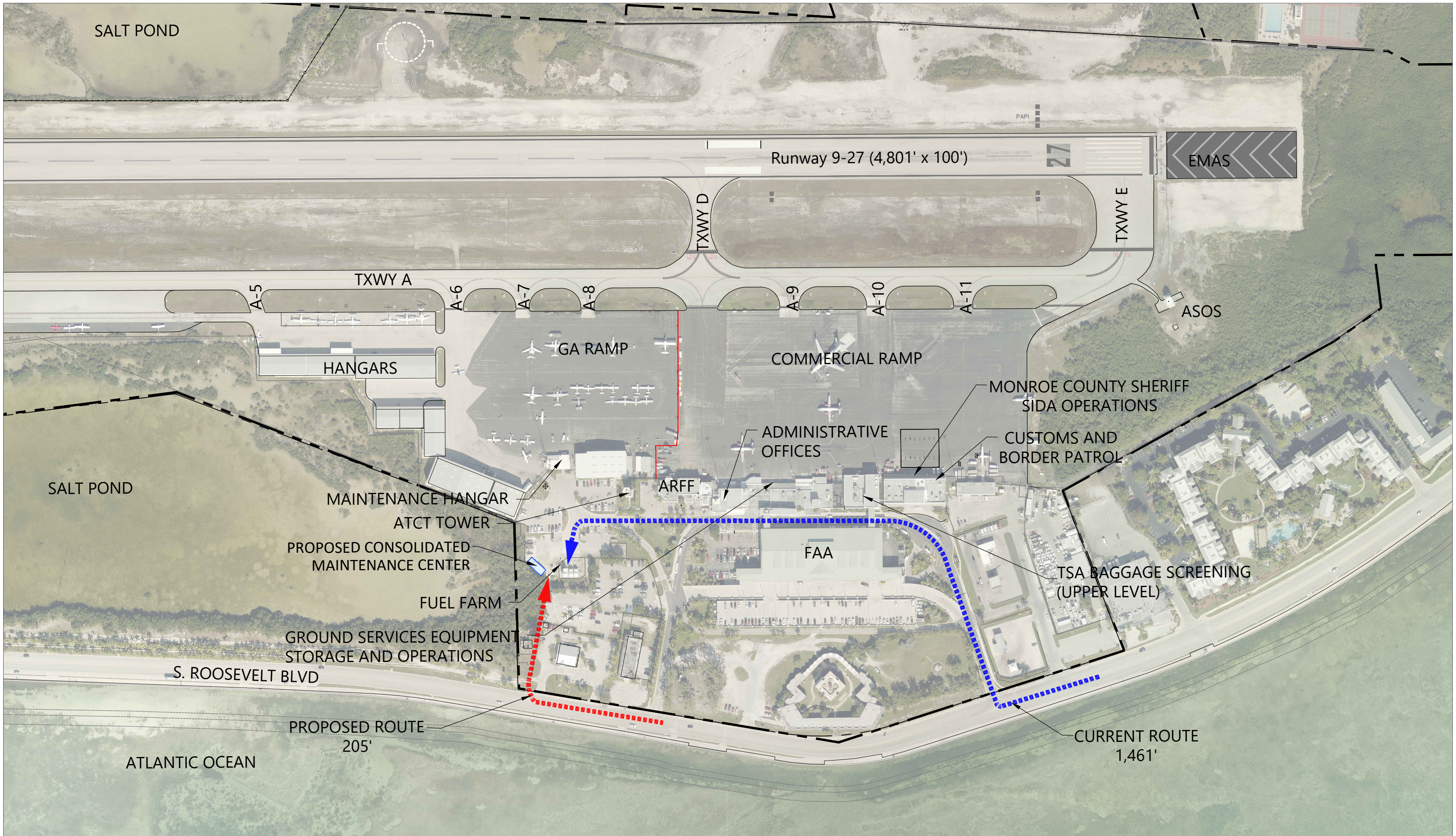
To provide an in-depth assessment of the future fuel farm facility's ability to accommodate forecast aircraft demand, the following types of data are needed: annual fuel sales, preferably from 2003 when the last Master Plan was completed; the peak fuel sales months for both Jet A and 100LL; and the current fuel supply that is maintained in number of days for both Jet A and 100LL. This information was not available during the assessment of the fuel farm. However, because the minimum standards are being met, and have even been exceeded in some instances since the 2003 Master Plan, expansion of this facility is not recommended. Further, it should be noted that the capacity of the Jet A fuel trucks has increased from 6,000 gallons to 15,000 gallons. This is an indication of EYW's expanded commercial service role and the ability of the fuel farm operator to accommodate this demand.

During follow-up interviews in the Fall of 2016, EYW senior staff in the Operations section indicated that a more direct on-airport route and access to the fuel farm should be explored. The issue of providing an alternate route for fuel delivery trucks that would remove them from the landside terminal roadway system is an important consideration because it will enhance safety. As described previously, these fuel trucks access the Airport's fuel farm using the same road that passengers use in the terminal area.

Because the primary use of this new access would be for fuel tank trucks and possibly semi-trucks, roadway design guidance provided in the American Association of State Highway and Transportation Officials' (AASHTO) publication entitled, "A Policy on Geometric Design of Highways and Streets" and commonly referred to as the "Green Book" was used to determine the most appropriate roadway width. The "Green Book" design guidance for lane widths indicated that between 9- to 12-foot lanes are appropriate for semi-truck use in urban areas. Consequently, a bi-directional fuel farm access road should be between 18 to 24 feet wide is recommended. It is further recommended that this proposed alternative access route to the fuel farm is located to the immediate west of the Tax Collector/Driver's License Office building on-airport property. Its alignment would extend to the north approximately 205-feet from Roosevelt Boulevard to the fuel farm property.

In addition to providing a truck delivery route for both the fuel farm and consolidated maintenance center, this Proposed Alternative Access Route to the Fuel Farm could be utilized by UPS air cargo trucks or any other vehicular traffic destined to the west side of the airport.

Exhibit 4.7-8 entitled, "Proposed Alternative Access Route to the Fuel Farm" shows both the current route of fueling trucks to the fuel farm and the suggested alternate access service road alignment starting at Roosevelt Boulevard and terminating between the fuel farm and the proposed site for a consolidated maintenance center.



SOURCE: Basemap and Aerial Photography, Jacobs, September, 2015
PREPARED BY: American Infrastructure Development, Inc., November, 2016.

EXHIBIT 4.7-8

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Proposed Alternative Access Route to the Fuel Farm

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4.8.2.2 Air Rescue and Firefighting Facility

Based on a site visit to EYW, information provided by Airport staff, and a tour of the ARFF in the spring of 2016, the ARFF is consistent with the operations criteria in AC 150/5210-15A.

The aircraft operations and critical aircraft (C-III) forecast through 2035 indicate that EYW will continue to be consistent with ARFF Index B airport standards. Consequently, the ARFF does not need to be expanded. It is recommended that aircraft operations and the aircraft fleet mix using EYW are monitored during subsequent updates to the Master Plan to identify when a milestone could be reached that would trigger the need for expansion of the ARFF.

4.8.2.3 Monroe County Sheriff's Office, Airport Security Division

The County's Security Division provides comprehensive services for EYW, in which it maintains, promotes, and enforces safety and security for all Airport users. A follow-up interview was conducted in the Fall of 2016 with the Director of Airport Security of EYW's Security Division. It was indicated that EYW's Security Division was satisfied with the facilities and could not identify any concerns that should be addressed as part of this Master Plan. Consequently, expansion or relocation of the facility is not recommended.

4.8.2.4 U.S. Customs and Border Patrol

Airport staff has provided information indicating that the current U.S. CBP facility contains 9,392 square feet, and its processing rate is 20 passengers per hour. In response to EYW's current and future international service, Airport management is in the process of implementing an expansion program for the facility. This expansion plan will involve two levels and will be implemented in five phases. Once completed, the first-floor space will be 12,118 square feet. The second level will be 2,626 square feet. The combined areas will provide 14,744 square feet of space. When expansion is completed, the capacity will accommodate 70 passengers per hour. The U.S. CBP expansion has been designed to improve passenger flow by separating the "primary processing" (Immigrations) and "secondary processing" (Customs) areas consistent with the *Department of Homeland Security's U.S. Border Patrol Facilities Design Guide*.

The County is currently implementing EYW's Phase II expansion plans for the U.S. CBP facility. The Phase II expansion will provide additional office space, passenger and employee restrooms, an employee locker area, an expanded security lobby, increased passenger queuing, and a generator on Level 1. The Phase III expansion will also involve Level 1 and provides additional office space, a conference room, restrooms, and communication security space. During Phase IV additional space will be provided on Level 1 to accommodate vertical circulation, cashier space, waiting areas, triage, labs, interview rooms, holding and search rooms, and staff offices. Phase V is the final phase, and it will involve both Level 1 and Level 2. Level 1 will include bag pickup/drop off areas, Immigrations and Customs processing areas, secure storage, the Port Director's office, waiting areas, and additional office space. Level 2 will include an additional conference room, mechanical rooms, staff breakrooms, restrooms, and vertical circulation.

4.8.2.5 Airport Maintenance Facilities

It is recommended that an Airport maintenance warehouse building be constructed. This building should consolidate all staff, store equipment and supplies, and maintain vehicles and vehicle parking in one area. The location of this building must have direct access to both the airside and landside.

It has been noted that Airport maintenance currently stores some of its equipment on revenue-producing property, namely the passenger terminal garage. The staff has indicated that some storage space has been lost in the garage because of accommodating the need for passenger parking space. They are now down to six spaces. Using a parking garage to store equipment results in lost revenue for EYW, and it reduces the availability of enclosed parking for passengers during peak times. In addition, passengers will have longer search times during peak times and will possibly experience further inconvenience if remote overflow parking must be used. The overflow parking lot is located further away from the passenger terminal, and vehicles are exposed to the elements.

It is recommended that the County explore building a consolidated maintenance facility. To construct this building on-Airport, a space program must be developed to determine the most appropriate size of the building footprint and the amount of land needed. A space program is developed by conducting an inventory of all space currently used, determining the size of the space, understanding its purpose, and interviewing staff to understand how they operate, in addition to identifying problems and how they can best be solved.

As part of this study, the Planning Team requested any previous information or studies that addressed the need for a maintenance building. It is our understanding that in 2008 the County proposed that a 1,000- square-foot, 14-foot-high Airport maintenance building be constructed next to the fuel farm. As stated previously, Airport maintenance has three Connex storage containers near the fuel farm. Combined, they provide 900 square feet in storage space. It is felt that this location provides acceptable access to both the airside and landside. A space program would confirm if the proposed size and location would address current and forecast needs. **Exhibit 4.7-9** depicts the proposed Airport maintenance facility location that was previously considered by EYW staff.

SOURCE: Basemap and Aerial Photography, Jacobs, September, 2015
PREPARED BY: American Infrastructure Development, Inc., November, 2016.

EXHIBIT 4.7-9

NORTH 0 50 ft

Proposed Maintenance Facility Site

Drawing: P:\Project-Orlando\Monroe County\Task 200 - EYW Master Plan\205- Facility Requirements\Support\4.7-9 EYW-NEW-MAINT-SITE.dwgLayout: Letter Plotted: Jun 11, 2020, 10:27PM